Electronic Supplementary Information (ESI)

A modular strategy for the synthesis of marine originated meroterpenoid-type natural products

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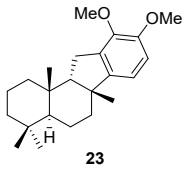
2. Supplementary Tables

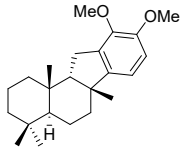
Supplementary Table S1. Comparison table for compound **23** ^{1}H NMR in $CDCl_3$.[1]



23

Compound 23, **400 MHz**	**Bisai's compound 23,** **400 MHz**	**Err** **$\Delta\delta_H$ (ppm)**
6.77−6.71 (m, 2H)	6.75 (s, 1H)	–
	6.74 (s, 1H)	–
3.87 (s, 3H)	3.87 (s, 3H)	0
3.84 (s, 3H)	3.84 (s, 3H)	0
2.93 (dd, *J* = 15.6, 8.0 Hz, 1H)	2.93 (dd, *J* = 15.8, 8.0 Hz, 1H)	0
2.81 (dd, J = 15.7, 11.9 Hz, 1H)	2.81 (dd, *J* = 15.6, 11.7 Hz, 1H)	0
1.84 (dd, *J* = 10.8, 8.7 Hz, 1H)	1.84 (dd, *J* = 12.0, 8.1 Hz, 1H)	0
1.75−1.57 (m, 3H)	1.77−1.67 (m, 4H)	–
–	1.63−1.57 (m, 4H)	–
1.47 (s, 3H)	1.47 (s, 3H)	0
1.46−1.40 (m, 4H)	1.46−1.43 (m, 2H)	–
1.36-1.25 (m, 3H)	–	–
1.21 (s, 3H)	1.21 (s, 3H)	0
0.90 (s, 3H)	0.90 (s, 3H)	0
0.88 (s, 3H)	0.88 (s, 3H)	0

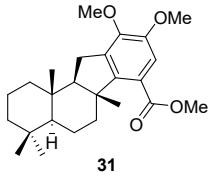
Supplementary Table S2. Comparison table for **compound 23** ^{13}C NMR in $CDCl_3$.[1]



23

Compound 23, 100 MHz	**Bisai's compound 23, 150 MHz**	**Err $\Delta\delta_C$ (ppm)**
18.3	18.4	-0.1
18.7	18.9	-0.2
21.9	22.0	-0.1
23.7	23.8	-0.1
25.7	25.8	-0.1
29.7	29.8	-0.1
32.9	33.0	-0.1
33.4	33.5	-0.1
36.3	36.5	-0.2
38.4	38.5	-0.1
39.1	39.3	-0.2
42.4	42.5	-0.1
45.0	45.1	-0.1
47.7	47.8	-0.1
56.0	56.1	-0.1
60.2	60.3	-0.1
62.8	62.9	-0.1
110.7	110.8	-0.1
116.1	116.2	-0.1
133.4	133.5	-0.1
145.2	145.3	-0.1
148.4	148.5	-0.1
150.6	150.7	-0.1

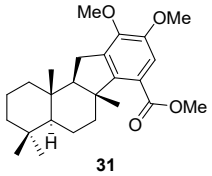
Supplementary Table S3. Comparison table for **compound 31** ^{1}H NMR in $CDCl_3$.[2]



31

compound 31, 400 MHz	**Andersen's compound 31, 400 MHz**	**Err $\Delta\delta_H$ (ppm)**
7.02 (s, 1H)	7.00 (s, 1H)	0.02
3.88 (s, 3H)	3.86 (s, 3H)	0.02
3.86 (s, 3H)	3.84 (s, 3H)	0.02
3.84 (s, 3H)	3.82 (s, 3H)	0.02
2.71 (dd, *J* = 5.8, 14.5 Hz, 1H)	2.69 (dd, *J* = 14.3, 6.3Hz, 1H)	0.02
2.56 (t, *J* = 13.7 Hz, 1H)	2.54 (dd, *J* = 14.3, 12.9Hz, 1H)	0.02
2.46 (d, *J* = 12.1 Hz, 1H)	2.44 (dt, *J* = 12.3, 3.4Hz, 1H)	0.02
1.72−1.52 (m, 5H)	–	–
1.25 (s, 3H)	1.22 (s, 3H)	-0.03
1.19−1.12 (m, 1H)	–	–
1.06 (s, 3H)	1.04 (s, 3H)	0.02
1.00−0.90 (m, 2H)	–	–
0.86(s, 3H)	0.84 (s, 3H)	0.02
0.85 (s, 3H)	0.83 (s, 3H)	0.02

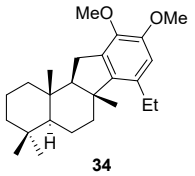
Supplementary Table S4. Comparison table for **compound 31** ^{13}C NMR in $CDCl_3$.[2]



31

compound 31, 100 MHz	**Andersen's compound 31, 150 MHz**	**Err $\Delta\delta_C$ (ppm)**
16.2	16.3	-0.1
18.3	18.3	0
19.4	19.5	-0.1
19.9	19.9	0
21.0	21.1	-0.1
25.2	25.2	0
33.0	33.1	-0.1
33.3	33.3	0
36.4	36.5	-0.1
37.1	37.1	0
40.1	40.2	-0.1
42.4	42.5	-0.1
48.0	48.1	-0.1
51.7	51.7	0
56.0	56.1	-0.1
57.0	57.1	-0.1
60.3	60.4	-0.1
64.8	64.8	0
111.5	111.6	-0.1
121.1	121.2	-0.1
137.0	137.0	0
148.3	148.3	0
148.6	148.7	-0.1
149.7	149.8	-0.1
168.2	168.3	-0.1

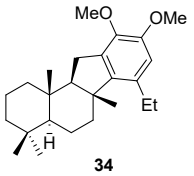
Supplementary Table S5. Comparison table for compound **34** ^{1}H NMR in $CDCl_3$.[2]



34

Compound 34, **400 MHz**	**Andersen's compound 34,** **400 MHz**	**Err** **$\Delta\delta_H$ (ppm)**
6.52 (s, 1H)	6.49 (s, 1H)	0.03
3.84 (s, 3H)	3.81 (s, 3H)	0.03
3.83 (s, 3H)	3.80 (s, 3H)	0.03
2.75−2.68 (m, 2H)	2.69 (m, 2H)	–
2.64−2.58 (m, 1H)	2.56 (dd, J = 14.5, 7.5 Hz, 1H)	–
2.52 (t, *J* = 13.7 Hz, 1H)	2.49 (dd, J = 14.5, 13.0 Hz, 1H)	0.03
2.39 (d, *J* = 12.1 Hz, 1H)	2.36 (dt, J = 12.0, 3.4 Hz, 1H)	0.03
1.83−1.64 (m, 4H)	–	–
1.60 (d, *J* = 13.5 Hz, 2H)	–	–
1.46−1.40 (m, 2H)	–	–
1.25 (t, *J* = 7.6 Hz, 3H)	1.22 (t, J = 7.6 Hz, 3H)	0.03
1.18 (dd, *J* = 13.4, 3.8 Hz, 1H)	–	–
1.12 (s, 3H)	1.08 (s, 3H)	0.04
1.05 (s, 3H)	1.02 (s, 3H)	0.03
1.00 (d, *J* = 3.8 Hz, 2H)	–	–
0.89 (s, 6H)	0.85 (s, 6H)	0.04

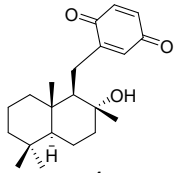
Supplementary Table S6. Comparison table for compound **34** ^{13}C NMR in $CDCl_3$.[2]



34

Compound 34, 100 MHz	Andersen's compound 34, 150 MHz	Err $\Delta\delta_C$ (ppm)
15.9	16.0	-0.1
16.0	16.1	-0.1
18.2	18.3	-0.1
19.6	19.7	-0.1
21.0	21.1	-0.1
21.2	21.3	-0.1
24.6	24.7	-0.1
25.1	25.2	-0.1
33.0	33.1	-0.1
33.3	33.4	-0.1
37.0	37.1	-0.1
39.2	39.3	-0.1
40.0	40.2	-0.2
42.4	42.5	-0.1
47.7	47.9	-0.2
55.8	55.9	-0.1
57.0	57.1	-0.1
60.2	60.4	-0.2
64.2	64.3	-0.1
110.9	111.1	-0.2
133.6	133.7	-0.1
135.7	135.8	-0.1
143.4	143.6	-0.1
144.7	144.8	-0.1
150.2	150.3	-0.1

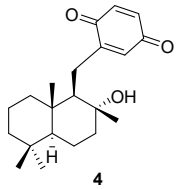
Supplementary Table S7. Comparison table for yahazunone (**4**) ^{1}H NMR in $CDCl_3$.[3]



4

Yahazunone (4), 400 MHz	**Baran's yahazunone (4), 600 MHz**	**Err $\Delta\delta_C$ (ppm)**
6.74 (d, *J* = 9.9 Hz, 1H)	6.73 (d, *J* = 10.1 Hz, 1H)	0.1
6.67 (dd, *J* = 10.0, 2.4 Hz, 1H)	6.67 (dd, *J* = 10.1, 2.6 Hz, 1H)	0
6.64 (s, 1H),	6.61 (d, *J* = 1.7 Hz, 1H)	0.3
2.62 (dd, *J* = 15.1, 6.0 Hz, 1H)	2.62 (ddd, *J* = 15.1, 6.1, 1.5 Hz, 1H)	0
2.47 (dd, *J* = 15.2, 5.1 Hz, 1H)	2.47 (ddd, *J* = 15.1, 5.0, 1.2 Hz, 1H)	0
1.87 (dt, *J* = 12.2, 3.0 Hz, 1H)	1.87 (dt, *J* = 12.5, 3.3 Hz, 1H)	0
1.68−1.62 (m, 2H)	1.72–1.62 (m, 2H)	–
1.60−1.24 (m, 7H)	1.67–1.31 (m, 7H)	–
1.16−1.13 (m, 1H)	1.26 (qd, *J* = 13.7, 3.3 Hz, 1H)	–
1.20 (s, 3H)	1.20 (s, 3H)	0
1.11 (dt, *J* = 13.7, 4.1 Hz, 1H)	1.11 (td, *J* = 13.4, 4.1 Hz, 1H)	0
0.92 (dd, *J* = 11.9, 1.7 Hz, 1H)	0.92 (dd, *J* = 12.7, 2.7 Hz, 1H)	0
0.87 (s, 3H)	0.87 (s, 3H)	0
0.86 (s, 3H)	0.86 (s, 3H)	0
0.79 (s, 3H)	0.79 (s, 3H)	0

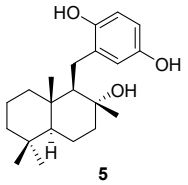
Supplementary Table S8. Comparison tables for yahazunone (**4**) ^{13}C NMR in $CDCl_3$.[3]



4

Yahazunone (4), 400 MHz	**Baran's yahazunone (4), 100 MHz**	**Err $\Delta\delta_C$ (ppm)**
15.2	15.5	-0.3
18.5	18.7	-0.2
20.4	20.5	-0.1
21.4	21.6	-0.2
23.7	23.9	-0.2
24.6	24.8	-0.2
33.2	33.4	-0.2
33.4	33.6	-0.2
39.4	39.6	-0.2
40.4	40.6	-0.2
41.6	41.8	-0.2
44.8	45.0	-0.2
56.1	56.3	-0.2
61.6	61.8	-0.2
73.9	74.0	-0.1
132.8	133.0	-0.2
136.1	136.3	-0.2
137.0	137.2	-0.2
152.6	152.8	-0.2
187.7	188.0	-0.3
188.0	188.2	-0.2

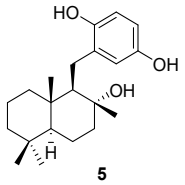
Supplementary Table S9. Comparison table for (+)-yahazunol (**5**) ^{1}H NMR in Acetone-d_6.[3,4]



5

(+)-Yahazunol (5), 400 MHz	Baran's (+)-yahazunol (5), 400 MHz	Seifert's (+)-yahazunol (5), 360 MHz
8.75 (d, *J* = 3.7 Hz, 1H)	8.75 (d, *J* = 3.9 Hz, 1H)	6.64 (d, *J* = 2.7 Hz, 1H)
7.43 (s, 1H)	7.43 (d, *J* = 1.3 Hz, 1H)	6.53 (d, *J* = 8.5 Hz, 1H)
6.65 (d, *J* = 2.7 Hz, 1H)	6.64 (d, *J* = 2.8 Hz, 1H)	6.49 (dd, *J* = 8.5, 2.7 Hz, 1H)
6.53 (d, *J* = 8.5 Hz, 1H)	6.53 (d, *J* = 8.5 Hz, 1H)	2.85 (dd, *J* = 20.7, 2.7 Hz, 1H)
6.48 (dd, *J* = 8.6, 2.8 Hz, 1H)	6.49 (dd, *J* = 8.6, 2.8 Hz, 1H)	2.40 (dd, *J* = 20.7, 8.5 Hz, 1H)
4.86 (d, *J* = 10.5 Hz, 1H)	4.86 (d, *J* = 10.5 Hz, 1H)	1.92 (dd, J = 16.9, 4.0 Hz, 1H)
2.87–2.82 (m, 1H)	2.88–2.82 (m, 1H)	–
2.39 (dd, *J* = 14.9, 6.1 Hz, 1H)	2.39 (dd, *J* = 15.0, 6.1 Hz, 1H)	–
1.92 (td, *J* = 12.4, 3.2 Hz, 1H)	1.92 (dt, *J* = 12.4, 3.2 Hz, 1H)	–
1.86−1.81 (m, 1H)	1.88–1.79 (m, 1H)	1.84 (m, 1H)
1.70−1.64 (m, 2H)	1.71 –1.53 (m, 4H)	1.66−1.62 (m, 2H)
1.61−1.54 (m, 3H)		1.57−1.33 (m, 5H)
1.38−1.31 (m, 2H)	1.42–1.30 (m, 6H)	
1.30 (s, 3H)		1.30 (s, 3H)
1.10 (td, *J* = 13.7, 4.4 Hz, 1H)	1.10 (td, *J* = 13.6, 13.1, 4.3 Hz, 1H)	1.11 (m, 1H)
0.97 (s, 3H)	0.97 (d, *J* = 0.9 Hz, 3H)	0.97 (s, 3H)
0.93 (dd, *J* = 11.5, 2.4 Hz, 1H)	0.94 (d, *J* = 2.4 Hz, 1H)	0.94 (d, *J* = 3.1 Hz, 1H)
0.86 (s, 3H)	0.86 (s, 3H)	0.86 (s, 3H)
0.82 (s, 3H)	0.82 (s, 3H)	0.83 (s, 3H)
0.72 (dt, *J* = 13.1, 3.5 Hz, 1H)	0.72 (td, *J* = 13.2, 3.7 Hz, 1H)	0.72 (dd, *J* = 17.9, 4.4 Hz, 1H)

Supplementary Table S10. Comparison tables for (+)-yahazunol (**5**) ^{13}C NMR in Acetone-d_6.



5

(+)-Yahazunol (5), 100 MHz	Baran's (+)-yahazunol (5), 150 MHz	Seifert's (+)-yahazunol (5), 75 MHz
15.8	15.8	15.9
18.9	19.0	19.1
21.1	21.1	21.2
21.7	21.8	21.9
24.5	24.5	24.6
27.8	27.9	28
33.7	33.7	33.8
33.7	33.8	33.9
40.5	40.5	41.6
41.3	41.3	41.4
42.4	42.5	42.6
44.4	44.5	44.6
56.8	56.9	57
62.2	62.2	62.4
75	75.1	75.1
114.2	114.2	114.3
117.4	117.4	117.4
118.8	118.8	118.9
131	131.1	131.2
149.6	149.7	149.7
150.3	150.3	150.4

References

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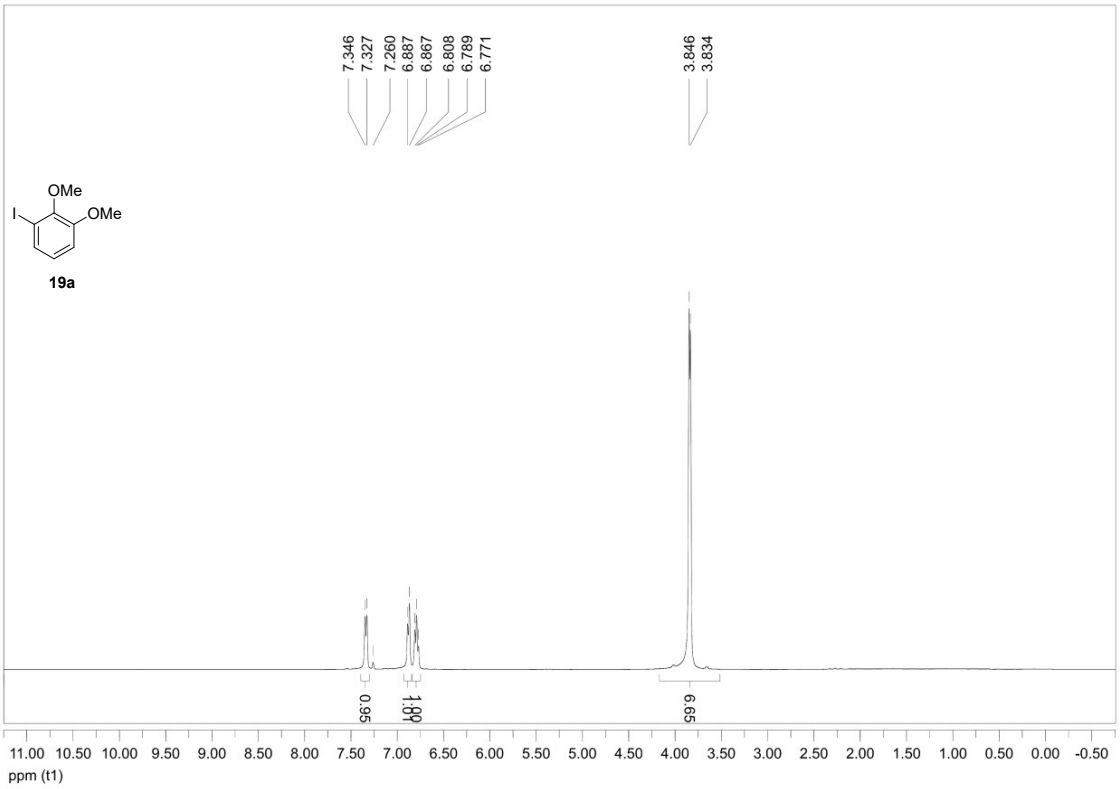
2. L. Yang, D. E. Williams, A. Mui, C. Ong, G. Krystal, R. V. Soest, R. J. Andersen, *Org. Lett.*, 2005, **7**, 1073–1076.
3. D. D. Dixon, J. W. Lockner, Q. Zhou, P. S. Baran, *J. Am. Chem. Soc.*, 2012, **134**, 8432–8435.
4. T. Laube, J. Schroeder, R. Stehle, K. Seifert, *Tetrahedron*, 2002, **58**, 4299– 4309.

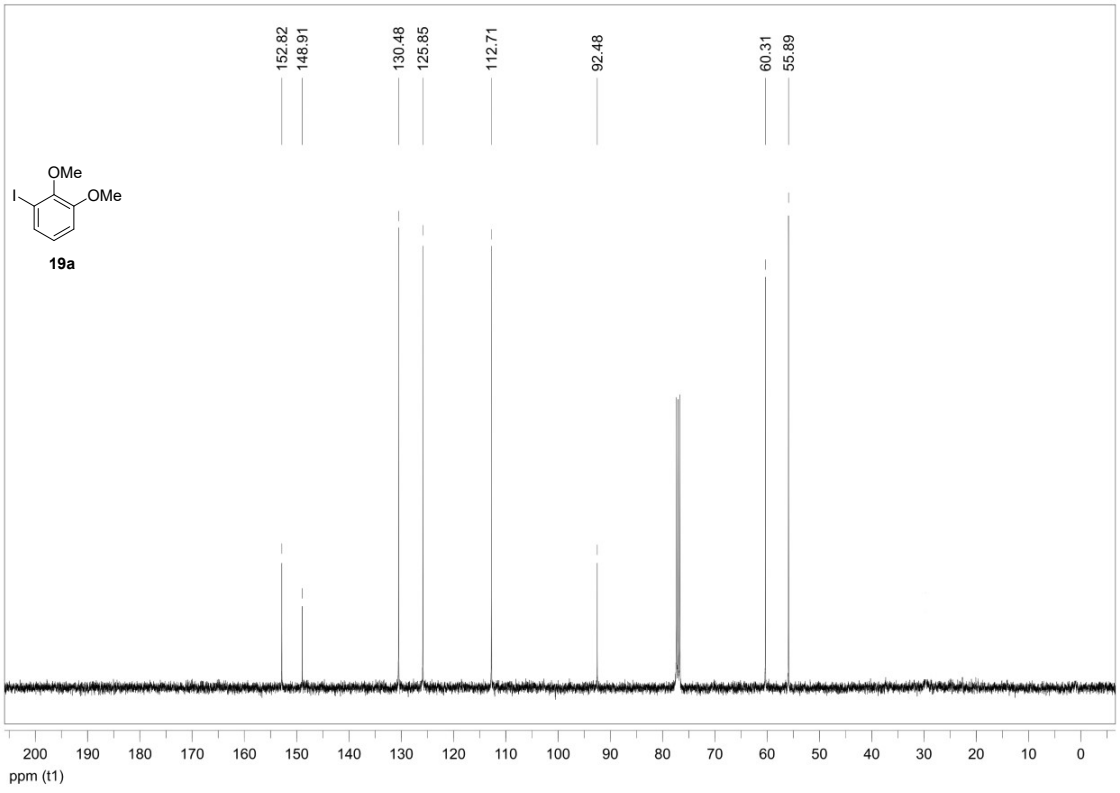
3. NMR Spectra of Compounds

Compound **19a**

^{1}H NMR (400 MHz, $CDCl_3$)

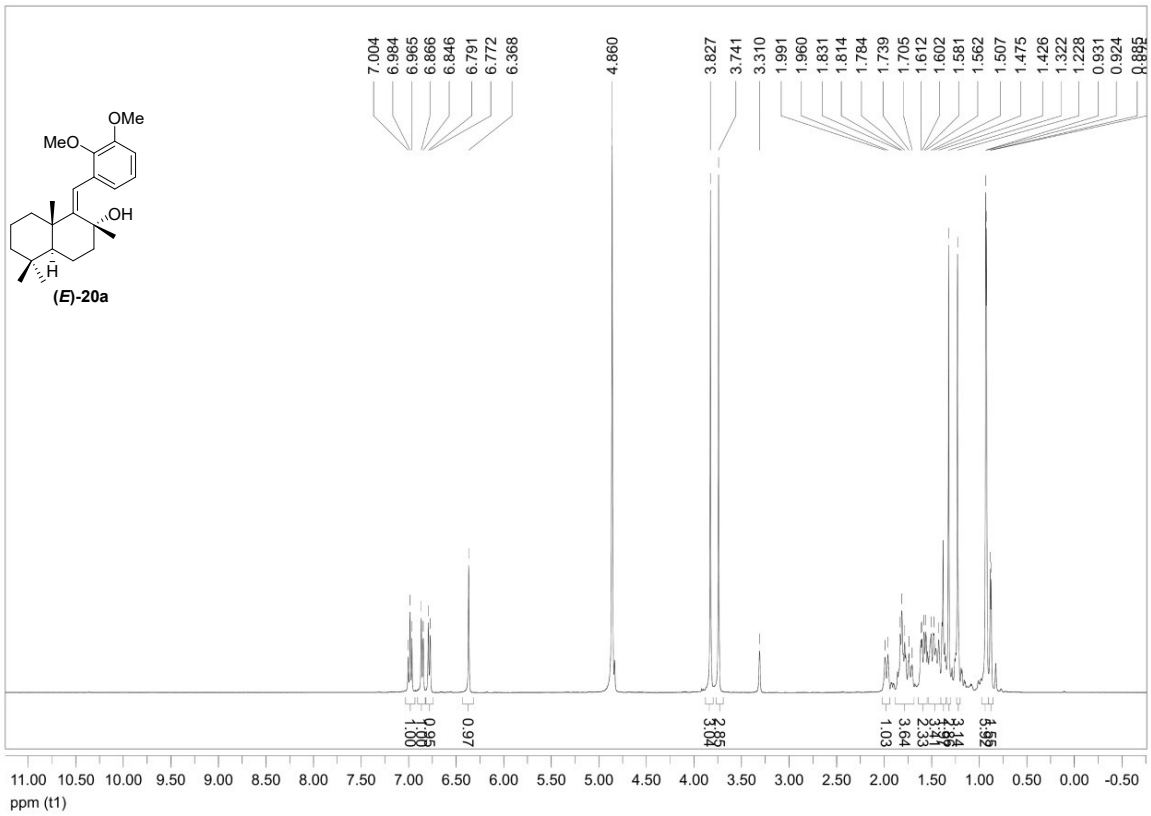


^{13}C NMR (100 MHz, $CDCl_3$)

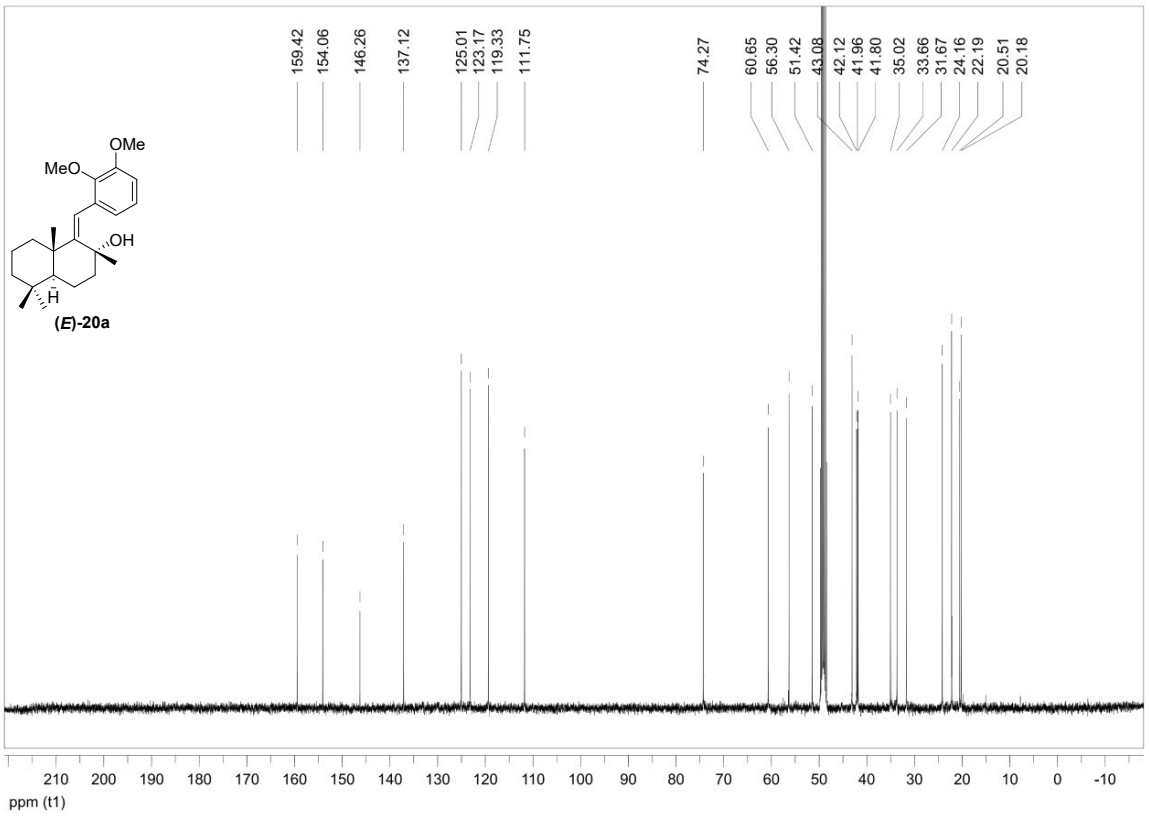


Compound **(*E*)-20a**

^{1}H NMR (400 MHz, MeOD)

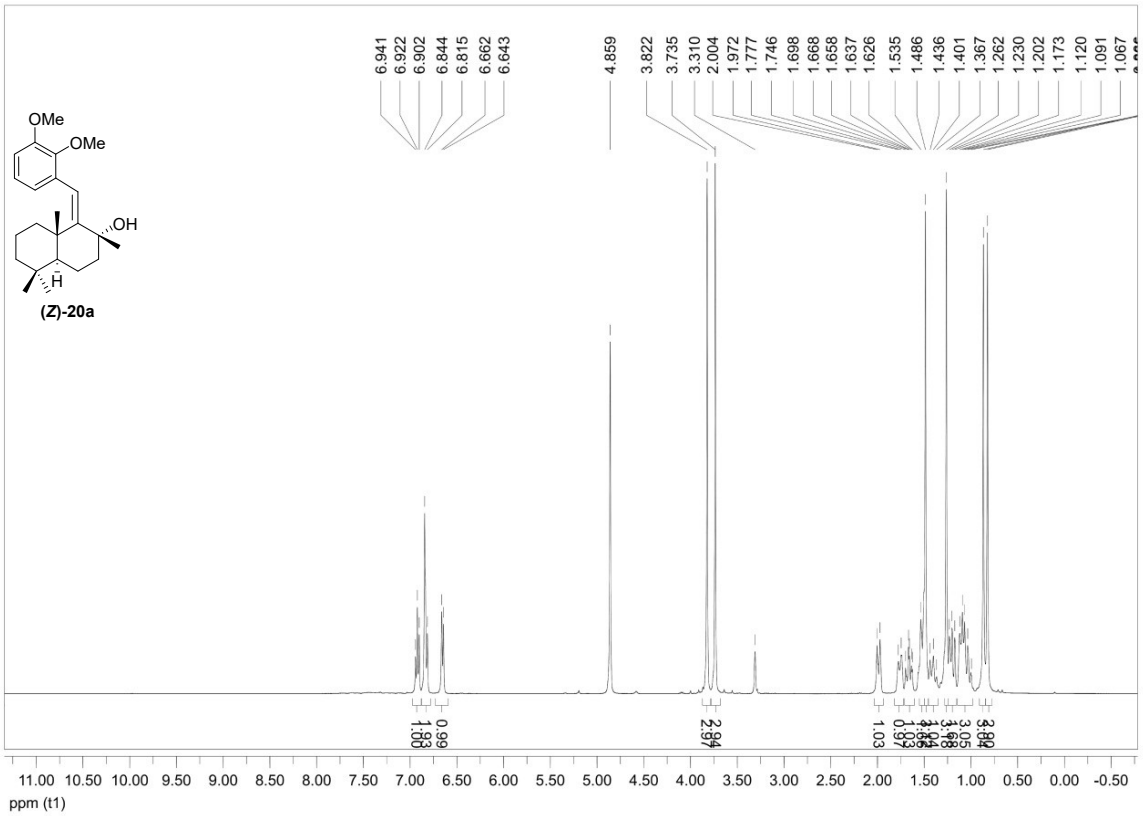


^{13}C NMR (100 MHz, MeOD)

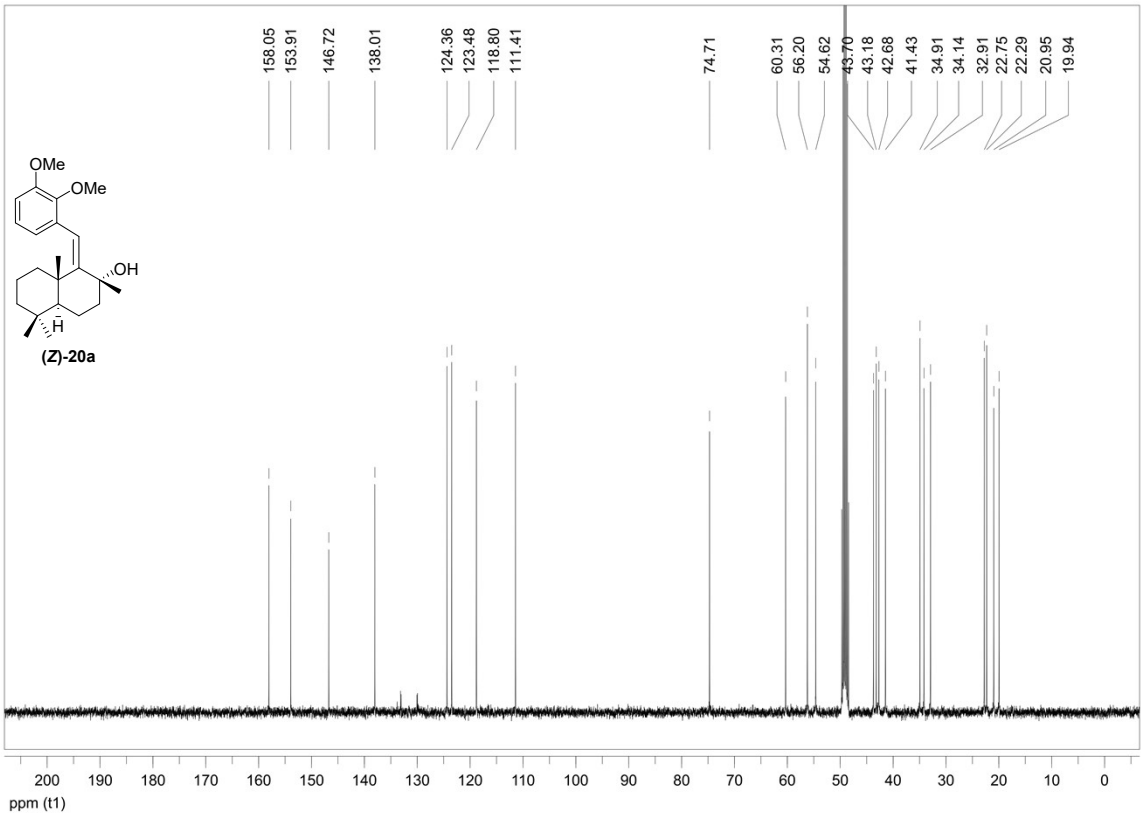


Compound **(*Z*)-20a**

^{1}H NMR (400 MHz, MeOD)

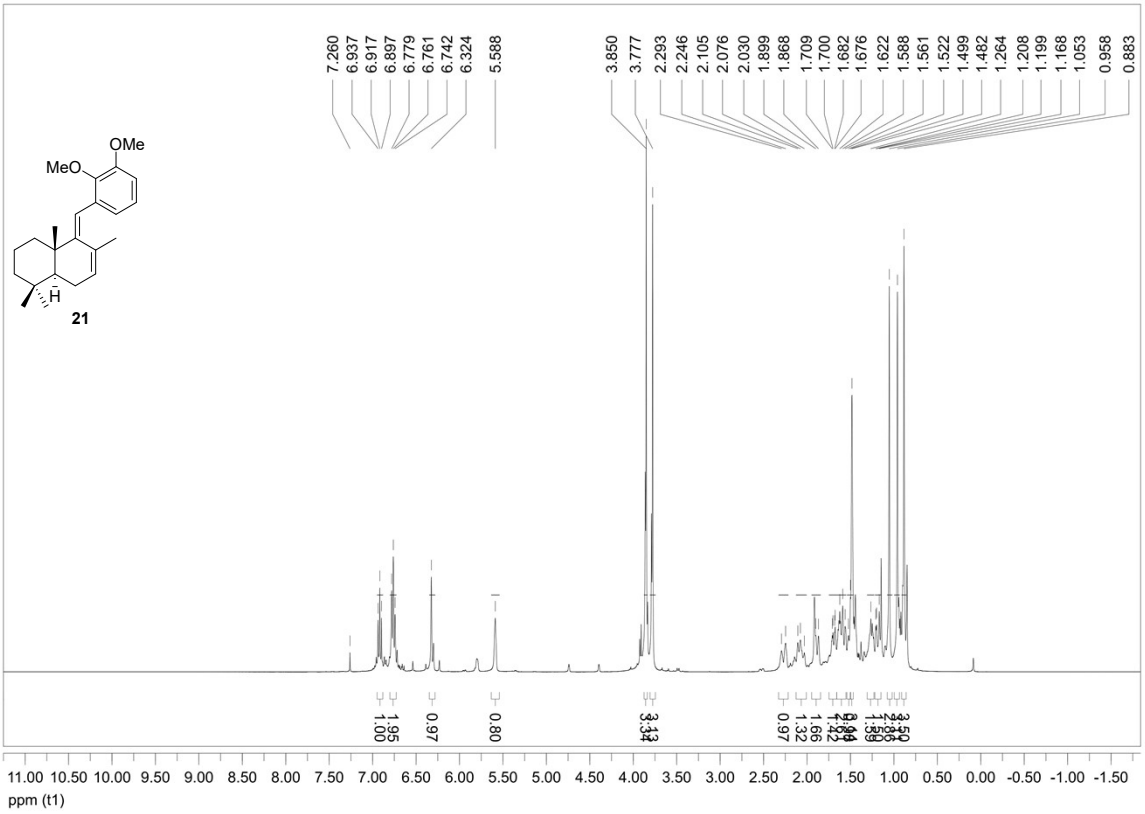


^{13}C NMR (100 MHz, MeOD)

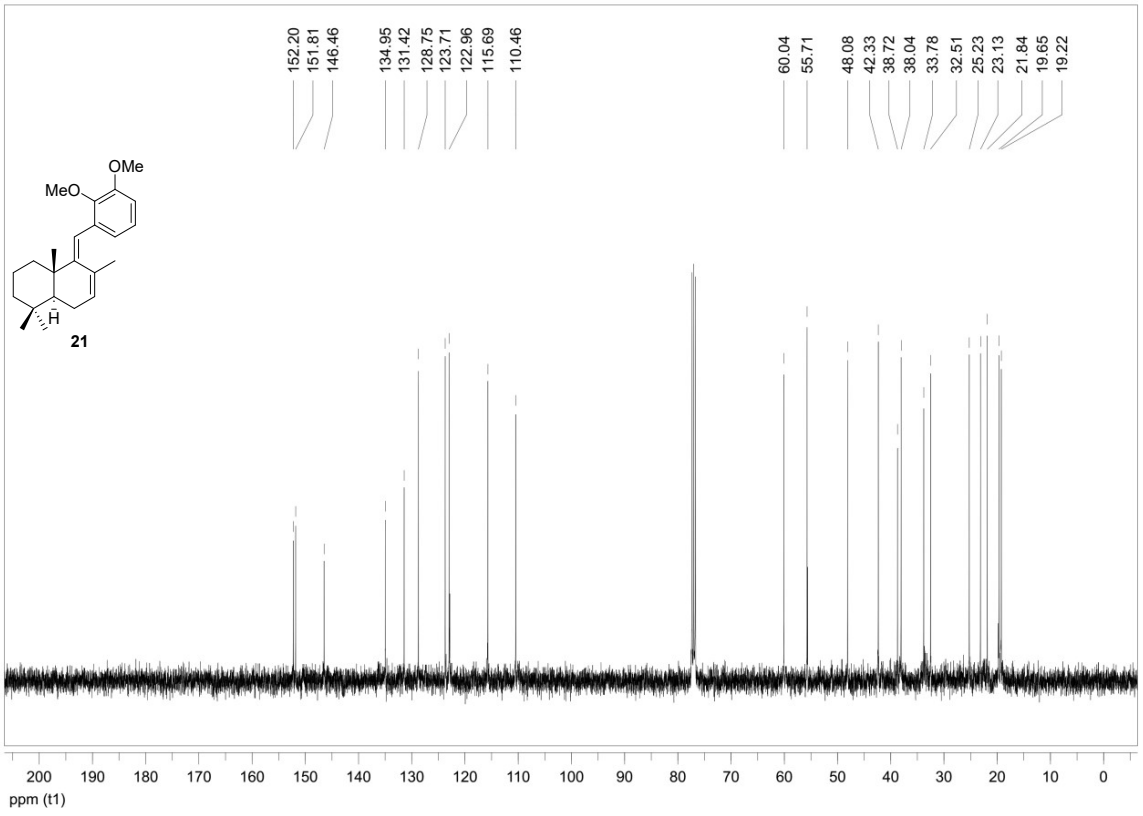


Compound **21**

^{1}H NMR (400 MHz, $CDCl_3$)

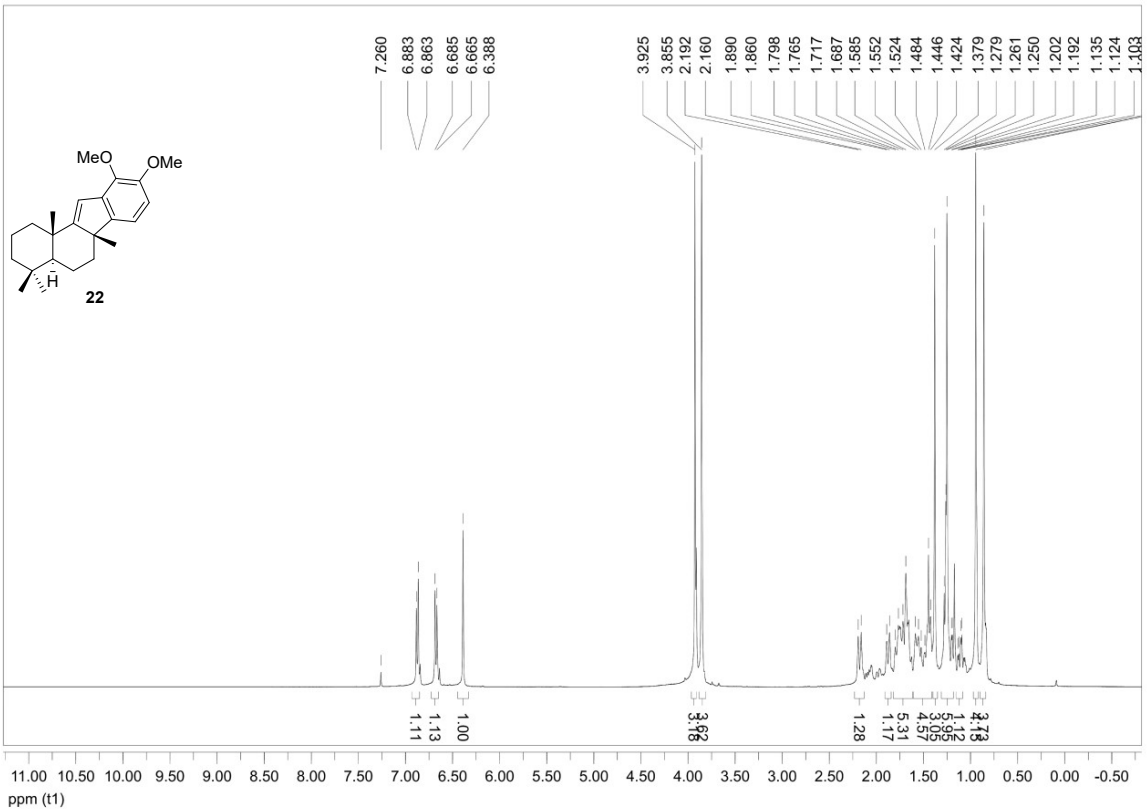


^{13}C NMR (100 MHz, $CDCl_3$)

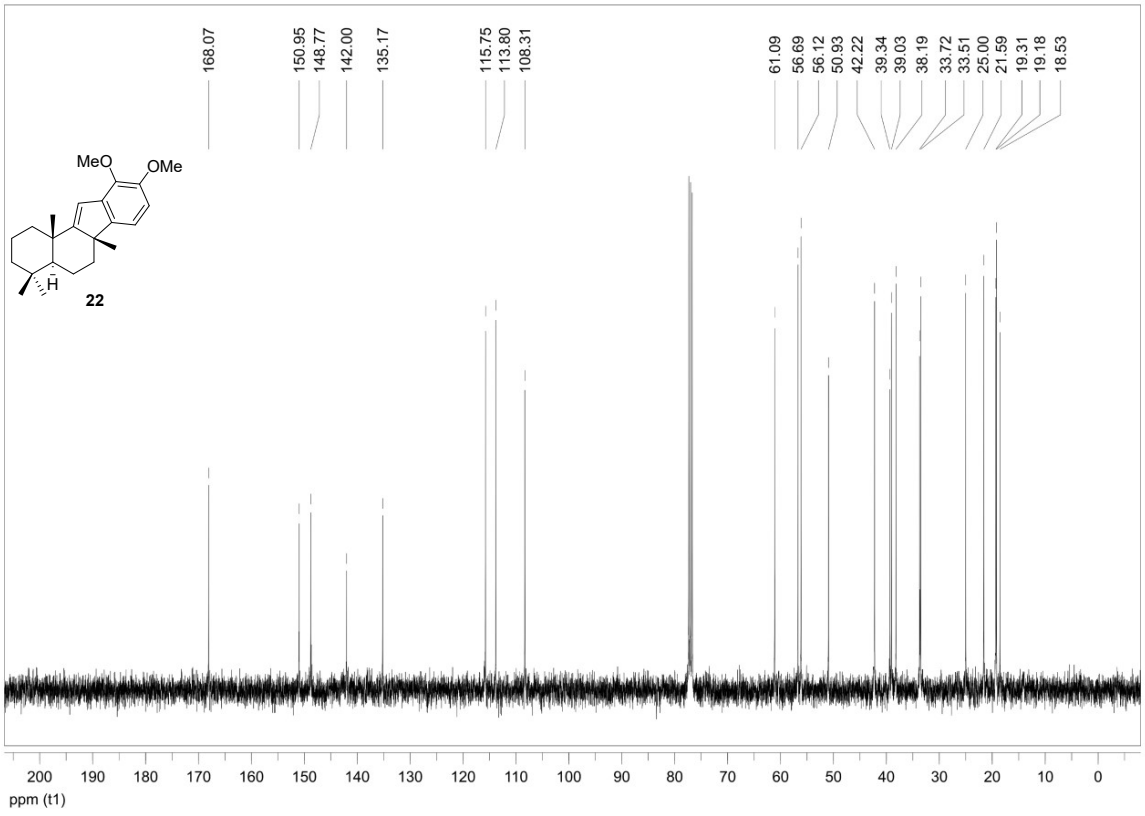


Compound **22**

^{1}H NMR (400 MHz, $CDCl_3$)

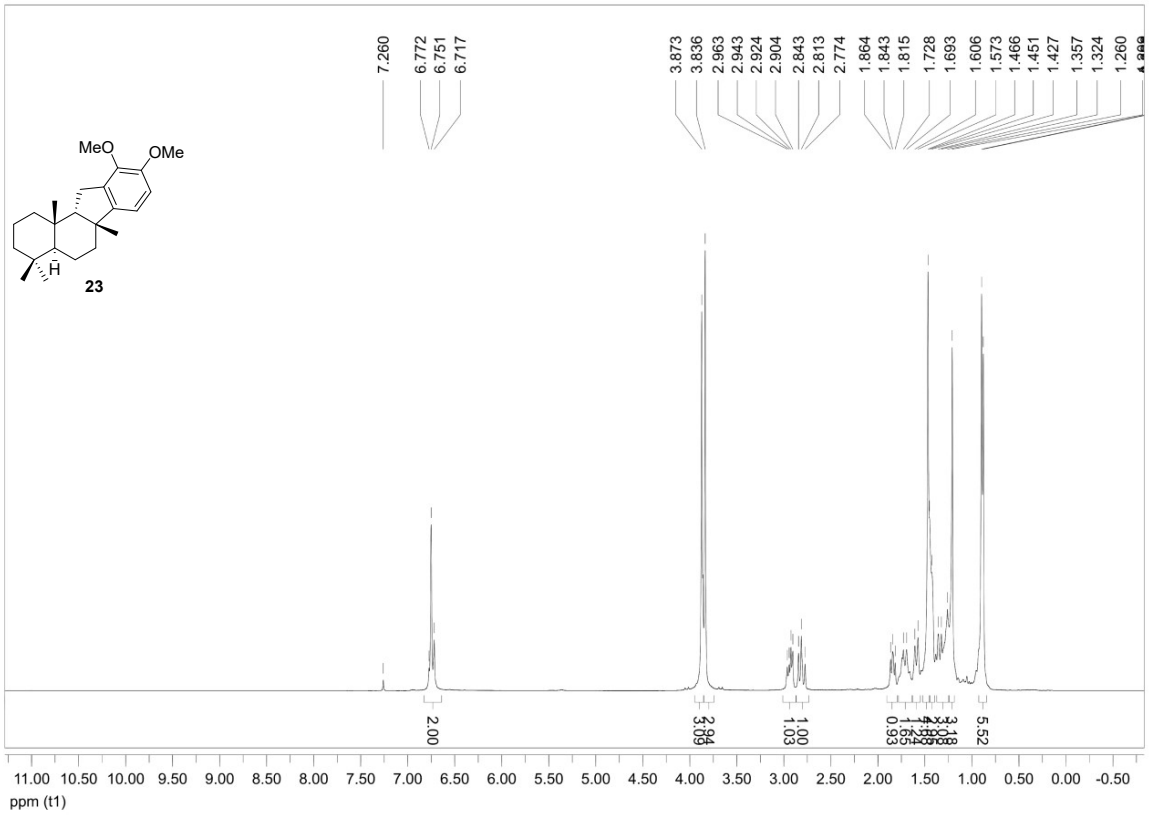


^{13}C NMR (100 MHz, $CDCl_3$)

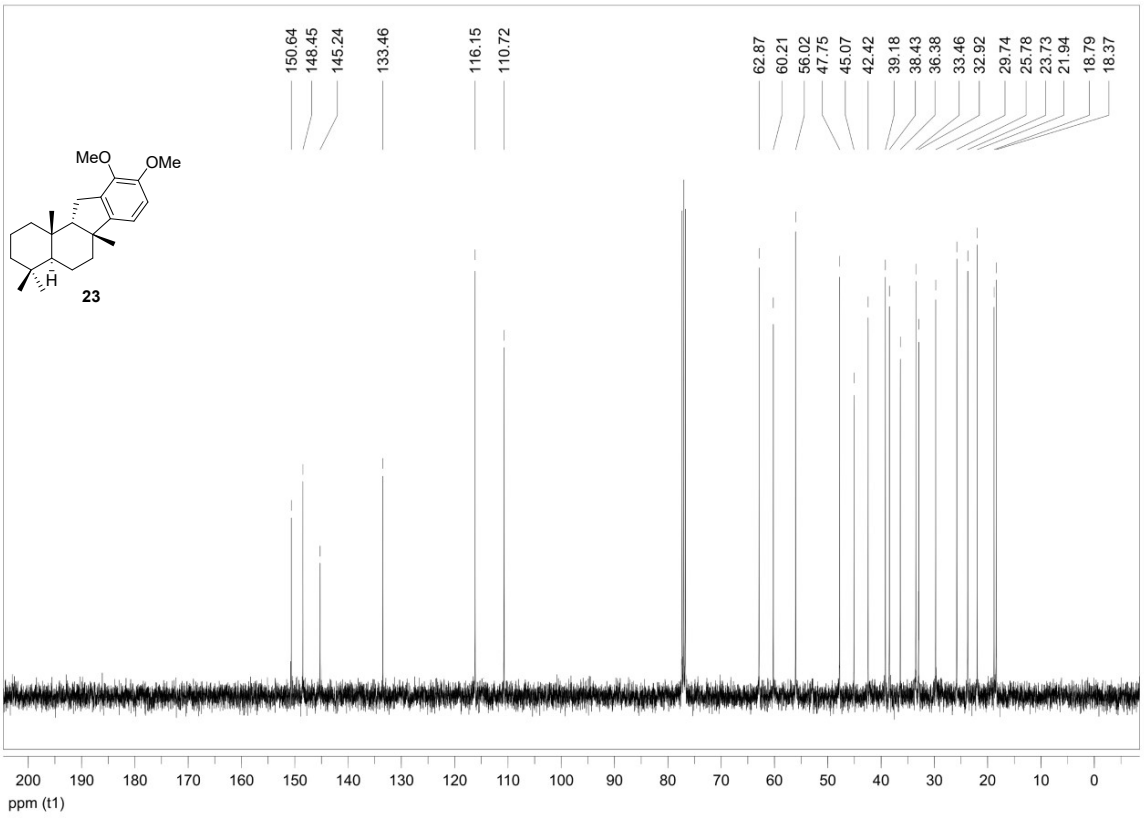


Compound **23**

^{1}H NMR (400 MHz, $CDCl_3$)



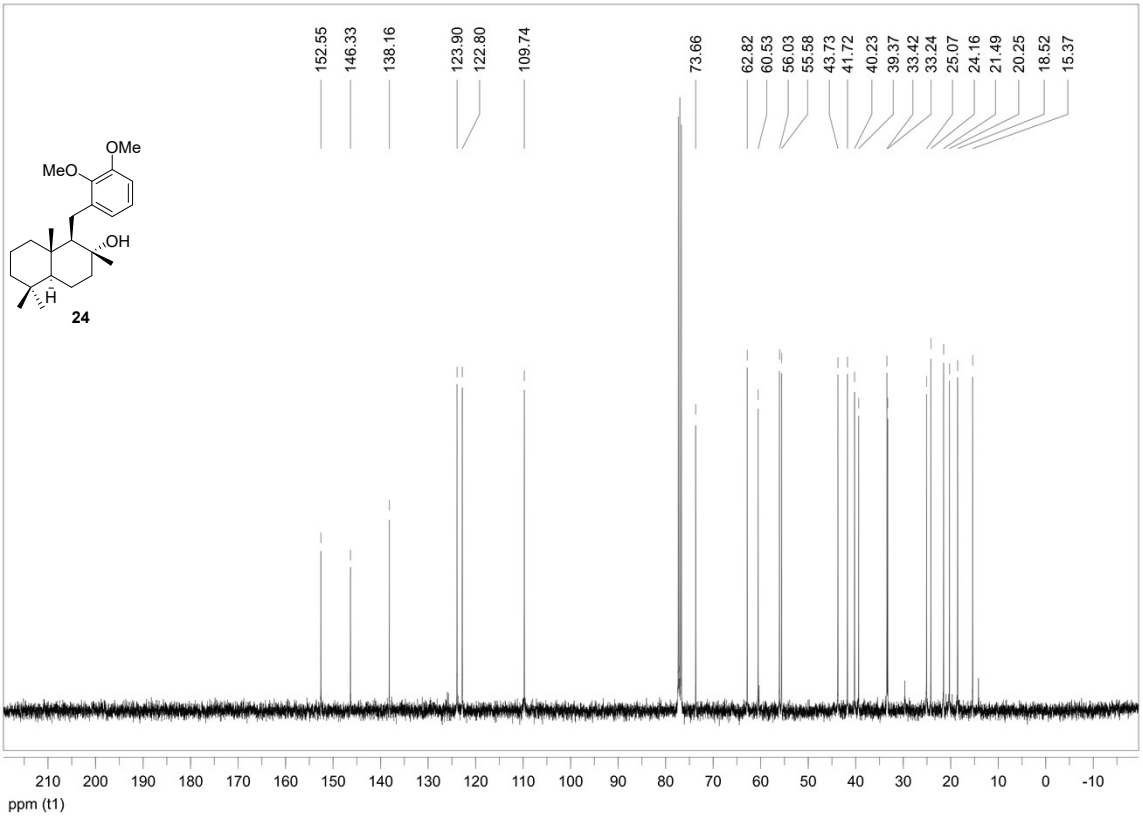
^{13}C NMR (100 MHz, $CDCl_3$)



Compound **24**

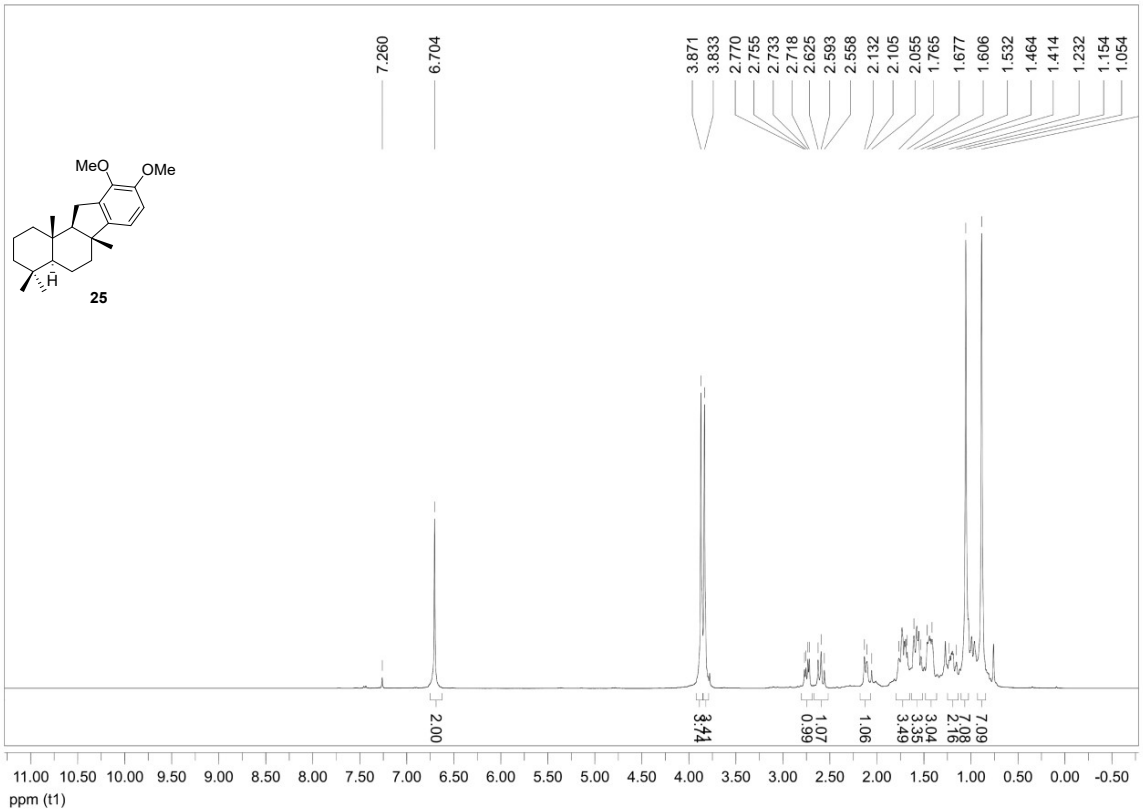
^{1}H NMR (400 MHz, $CDCl_3$)

^{13}C NMR (100 MHz, $CDCl_3$)

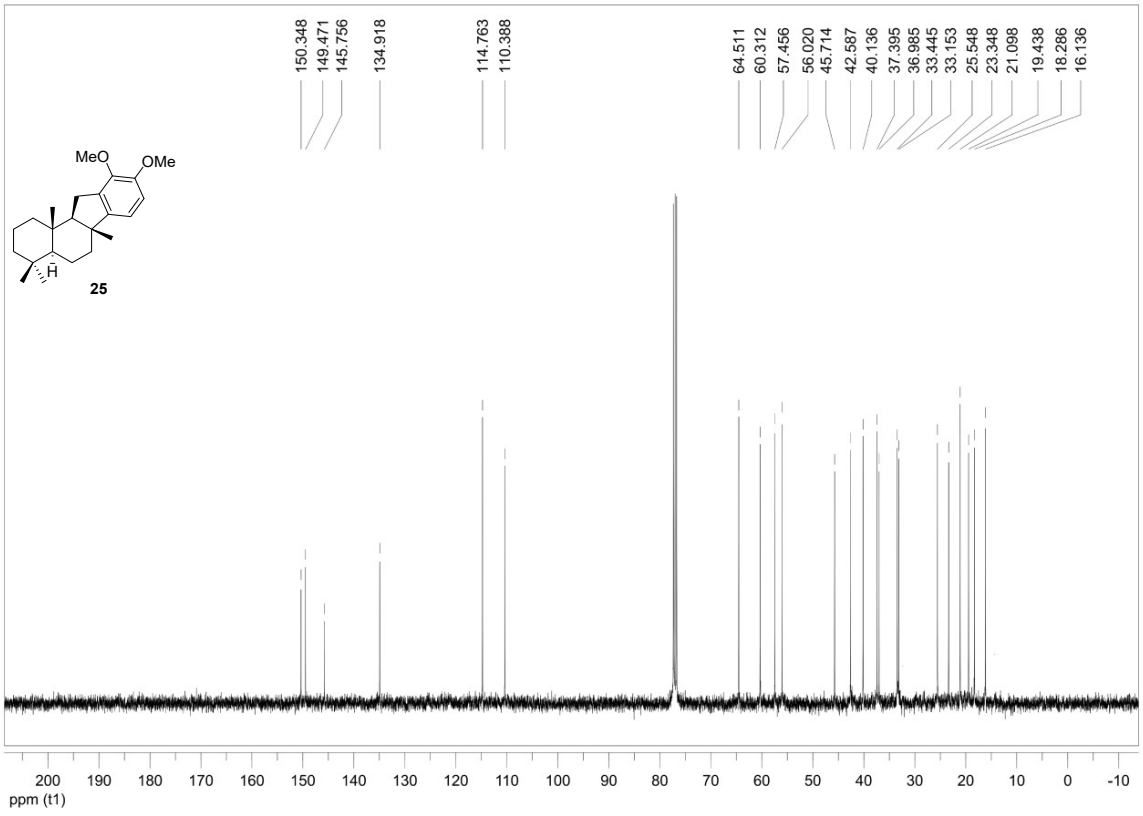


Compound **25**

^{1}H NMR (400 MHz, $CDCl_3$)

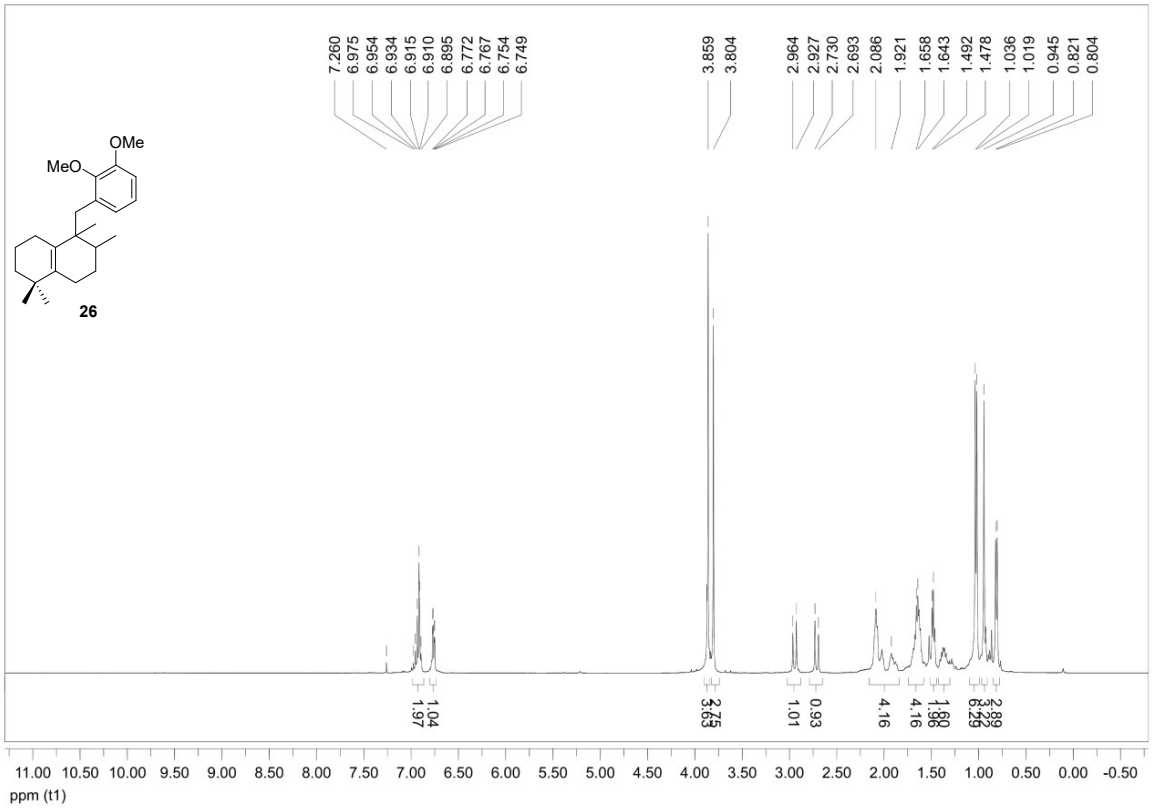


^{13}C NMR (100 MHz, $CDCl_3$)

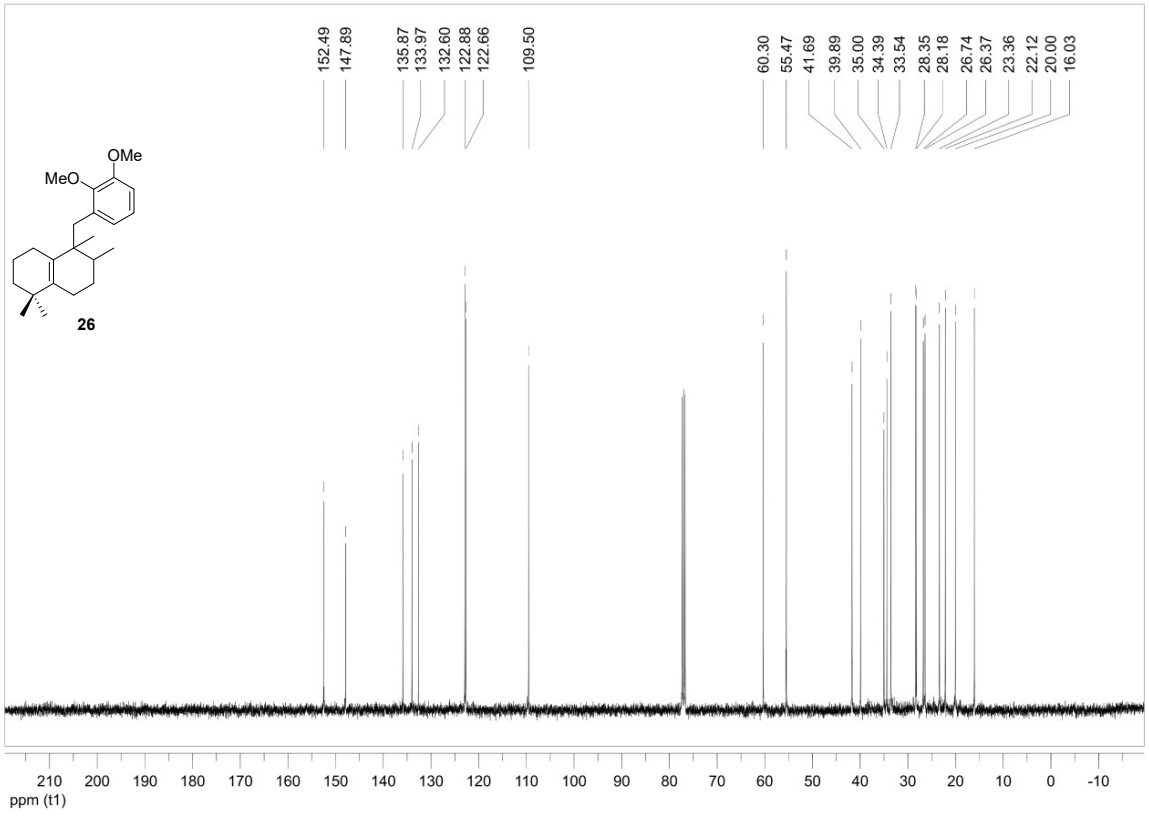


Compound **26**

^{1}H NMR (400 MHz, $CDCl_3$)

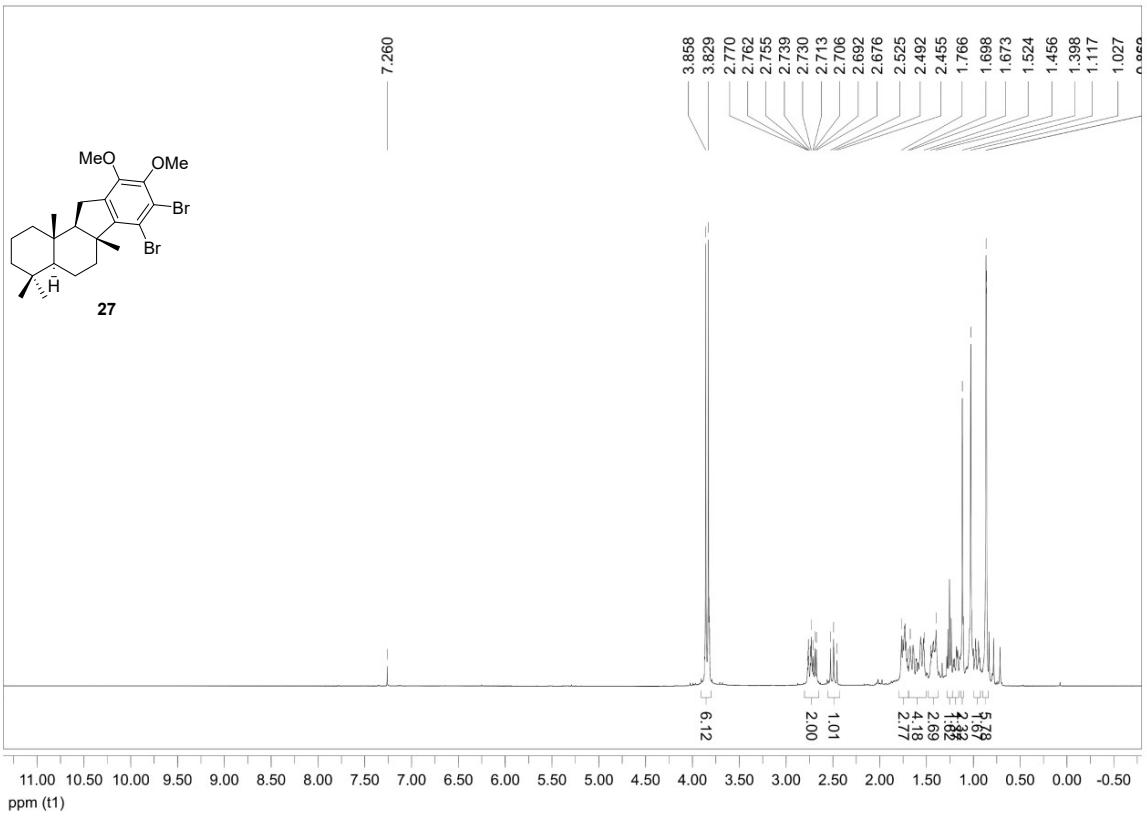


^{13}C NMR (100 MHz, $CDCl_3$)

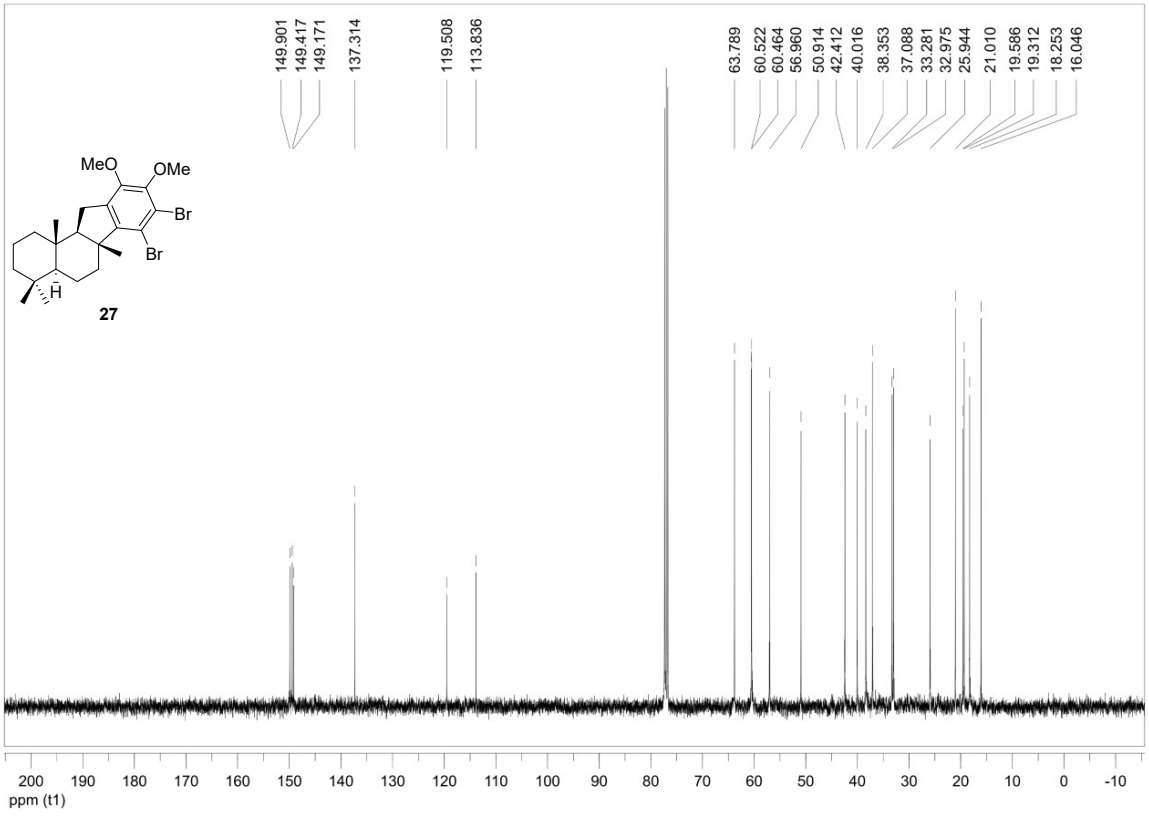


Compound **27**

^{1}H NMR (400 MHz, $CDCl_3$)

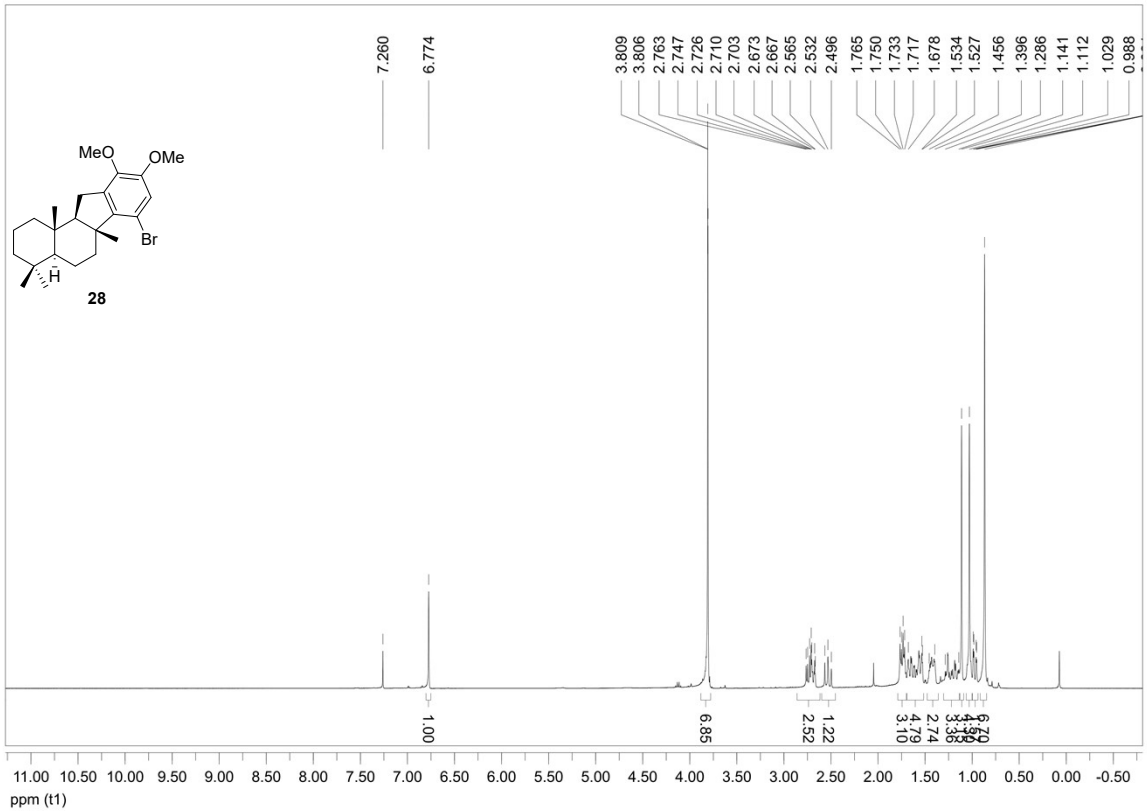


^{13}C NMR (100 MHz, $CDCl_3$)

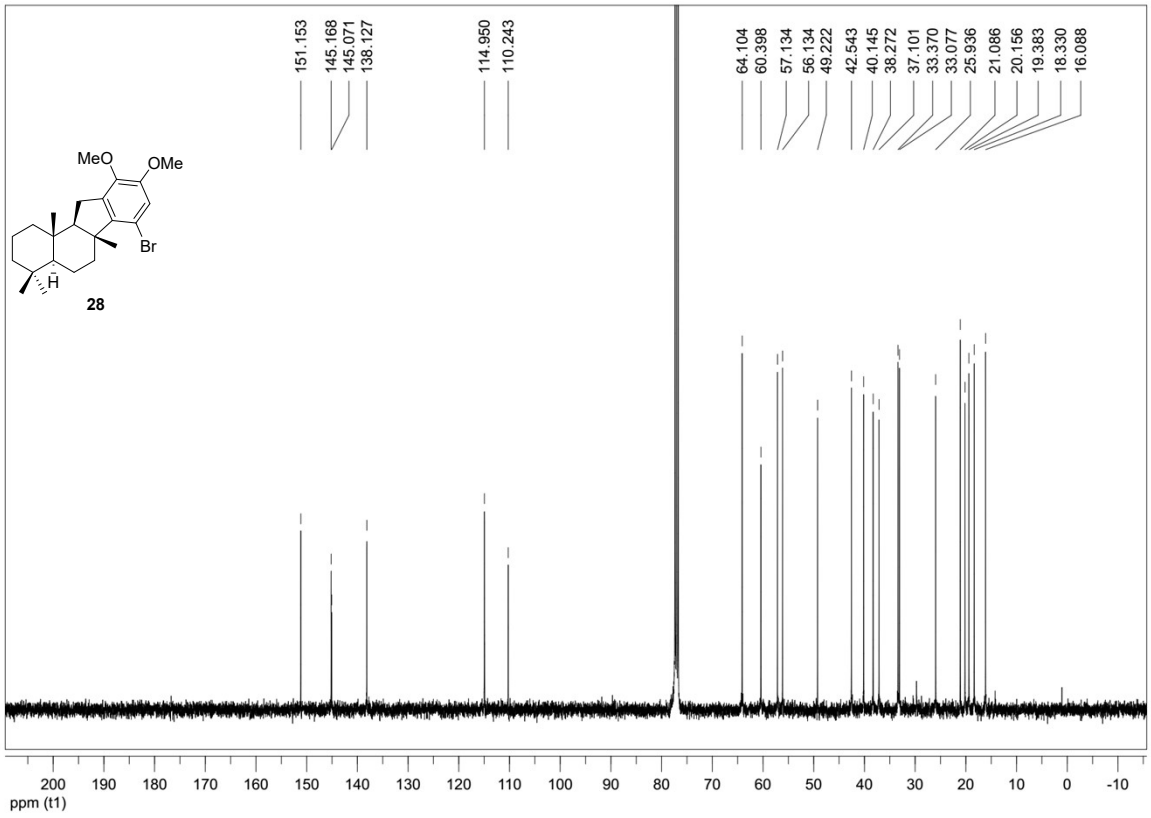


Compound **28**

^{1}H NMR (400 MHz, $CDCl_3$)

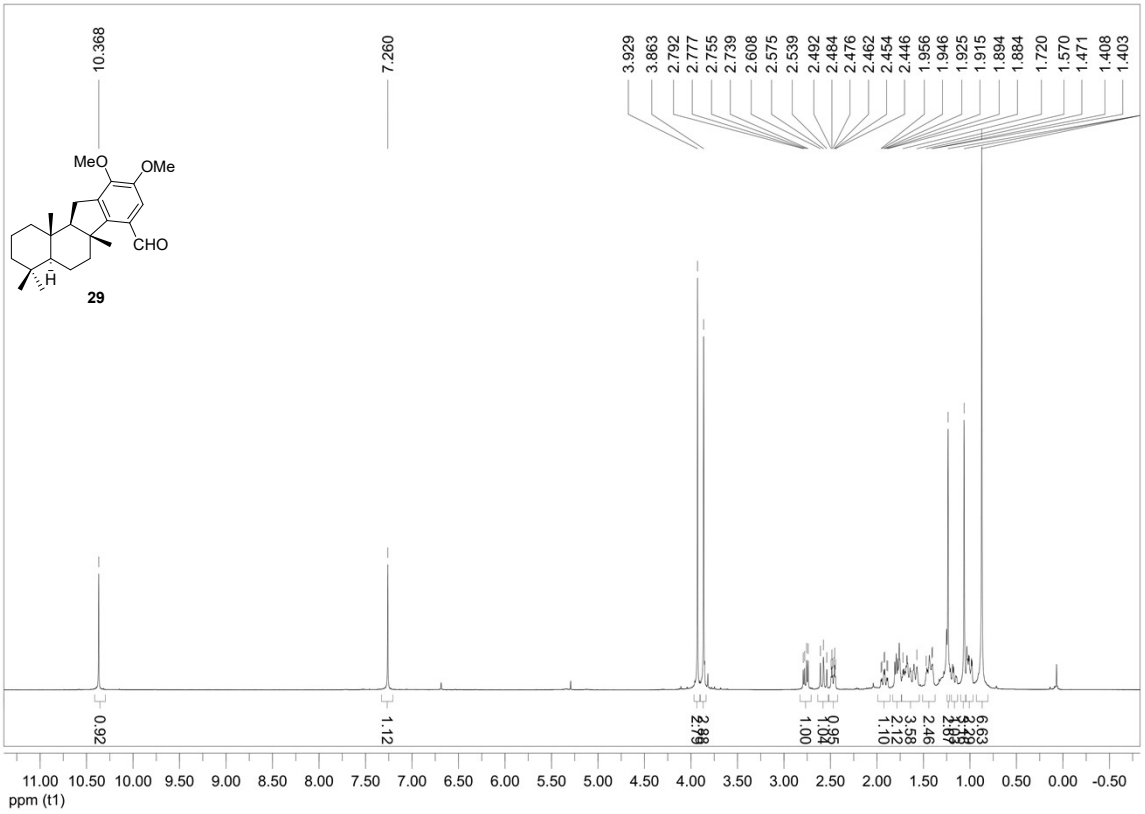


^{13}C NMR (100 MHz, $CDCl_3$)

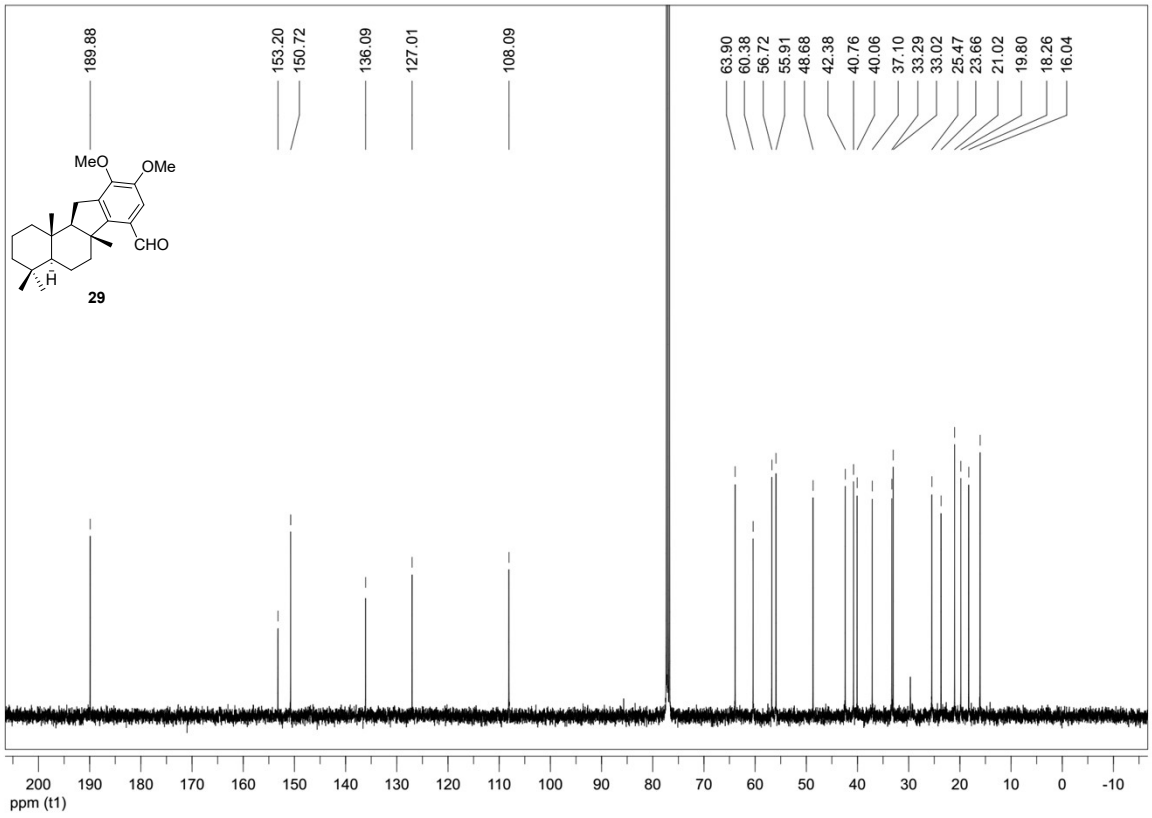


Compound **29**

^{1}H NMR (400 MHz, $CDCl_3$)

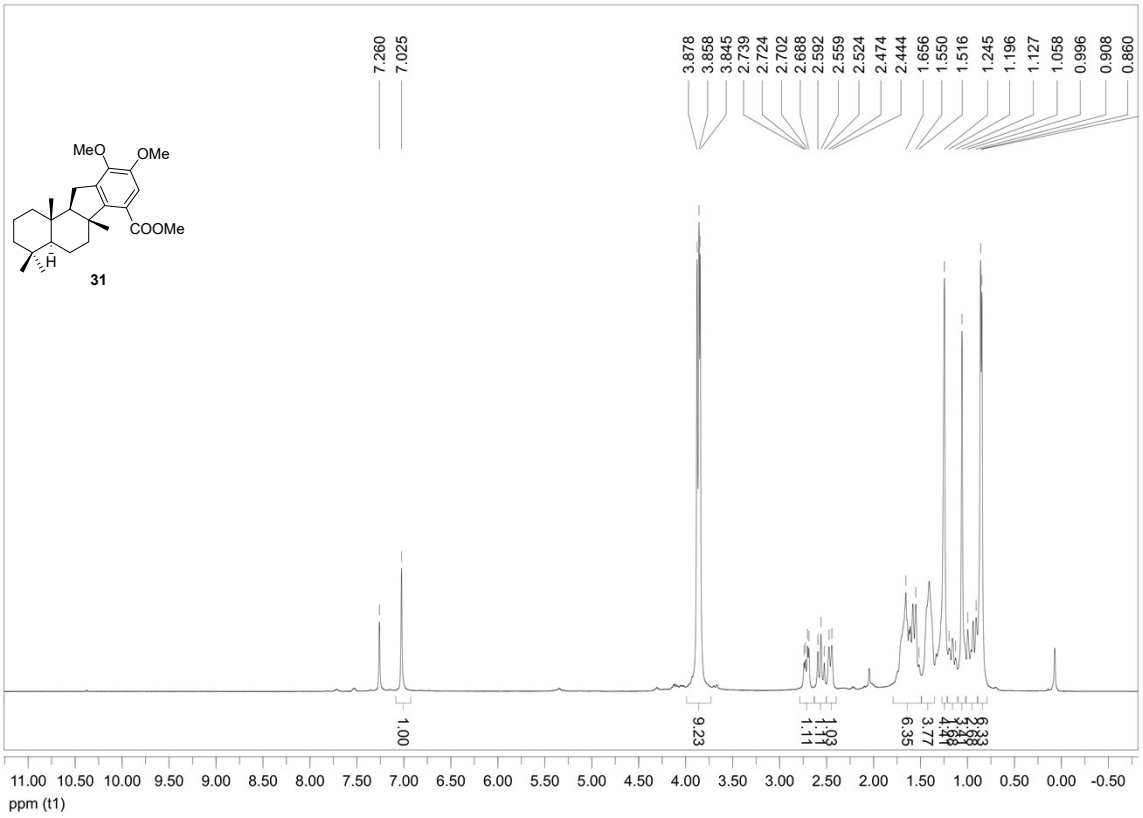


^{13}C NMR (100 MHz, $CDCl_3$)

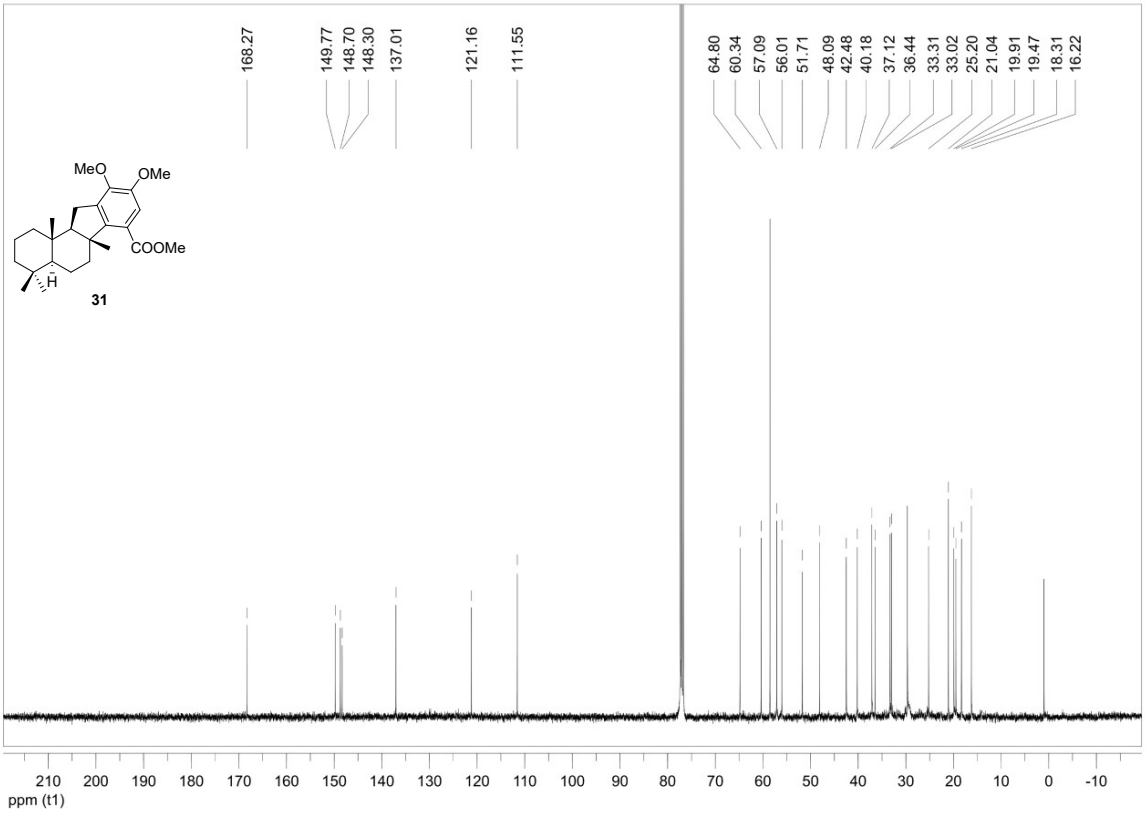


Compound **31**

^{1}H NMR (400 MHz, $CDCl_3$)

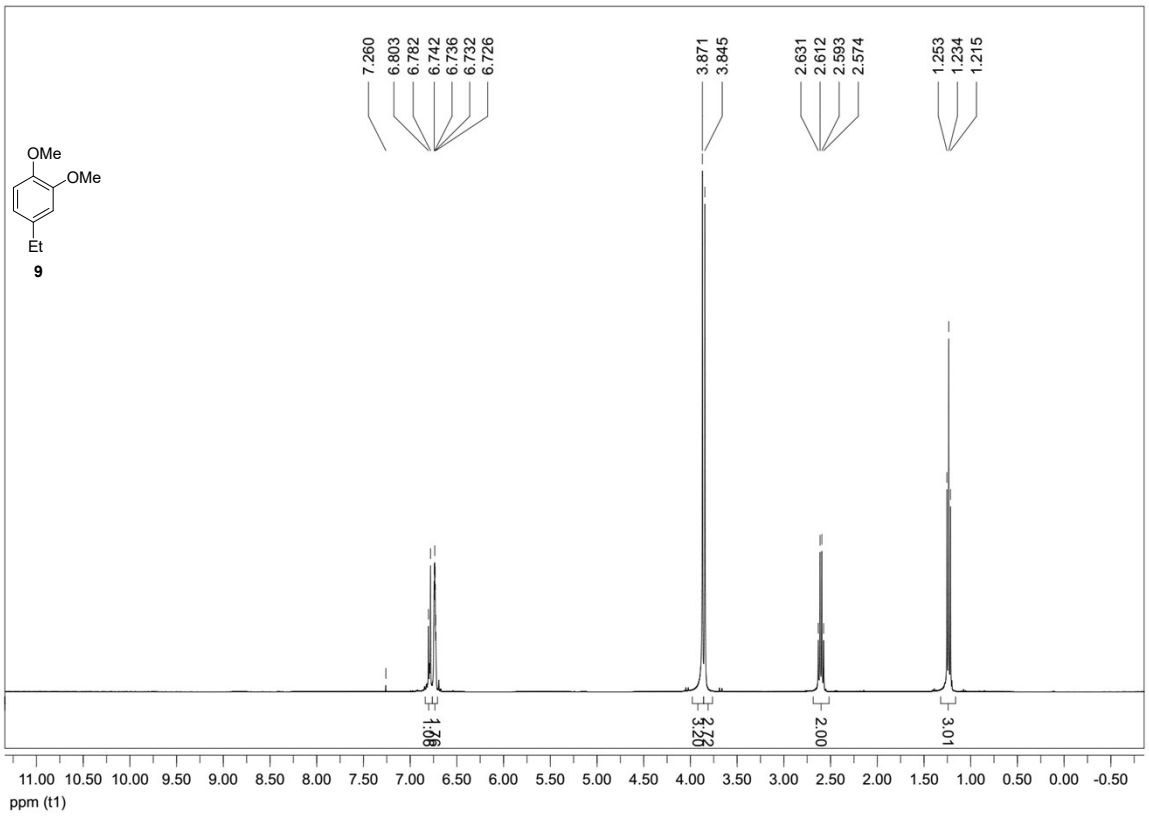


^{13}C NMR (100 MHz, $CDCl_3$)

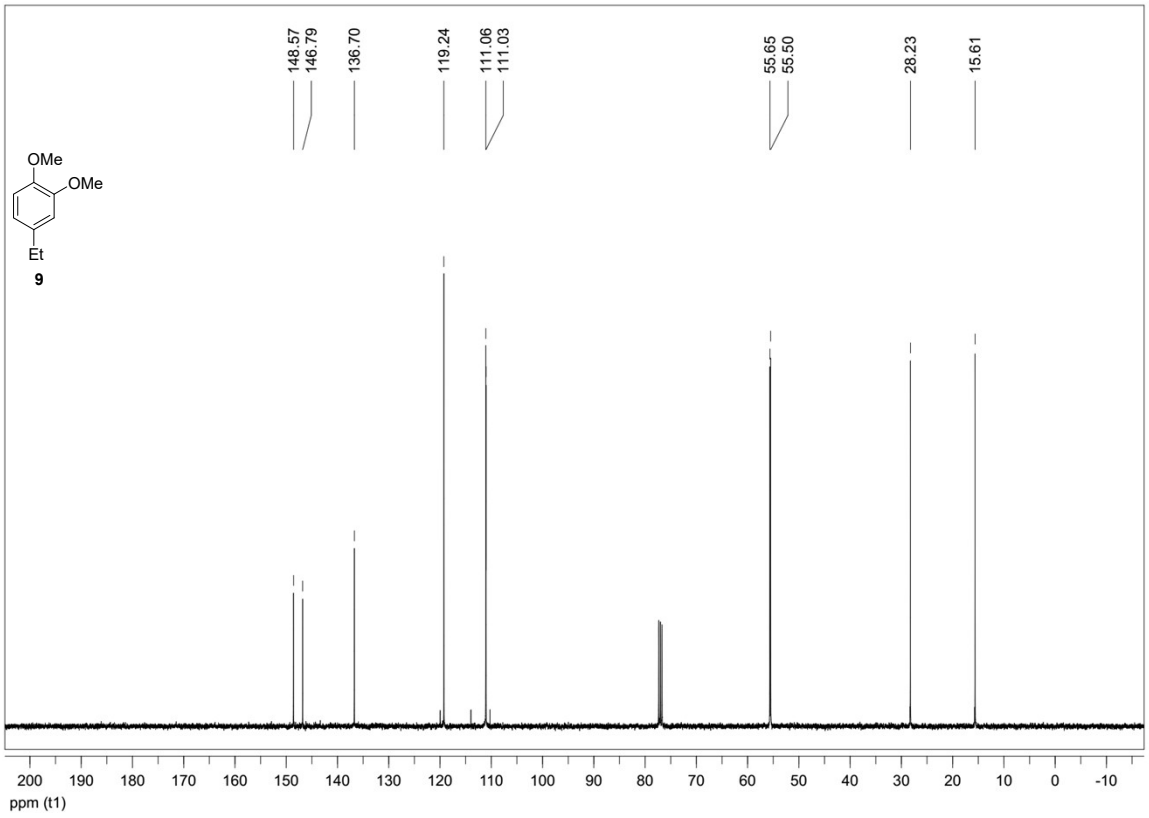


Compound **9**

^{1}H NMR (400 MHz, $CDCl_3$)

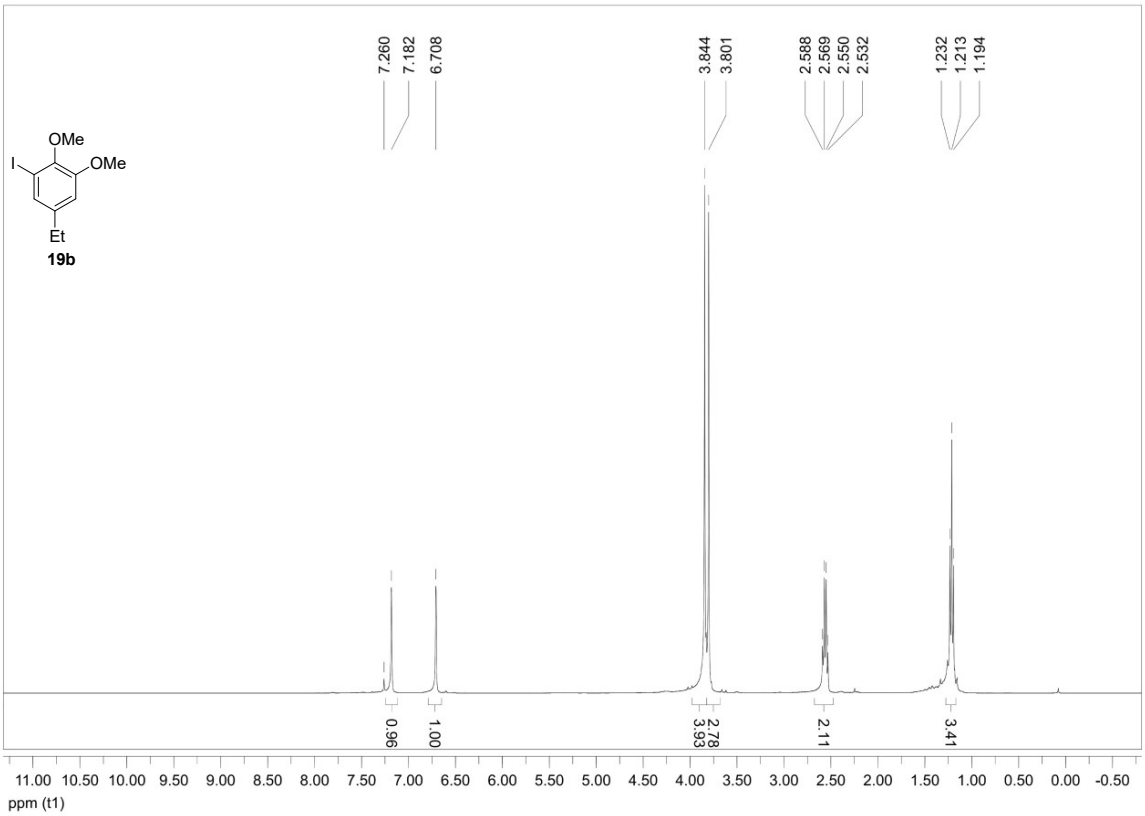


^{13}C NMR (100 MHz, $CDCl_3$)

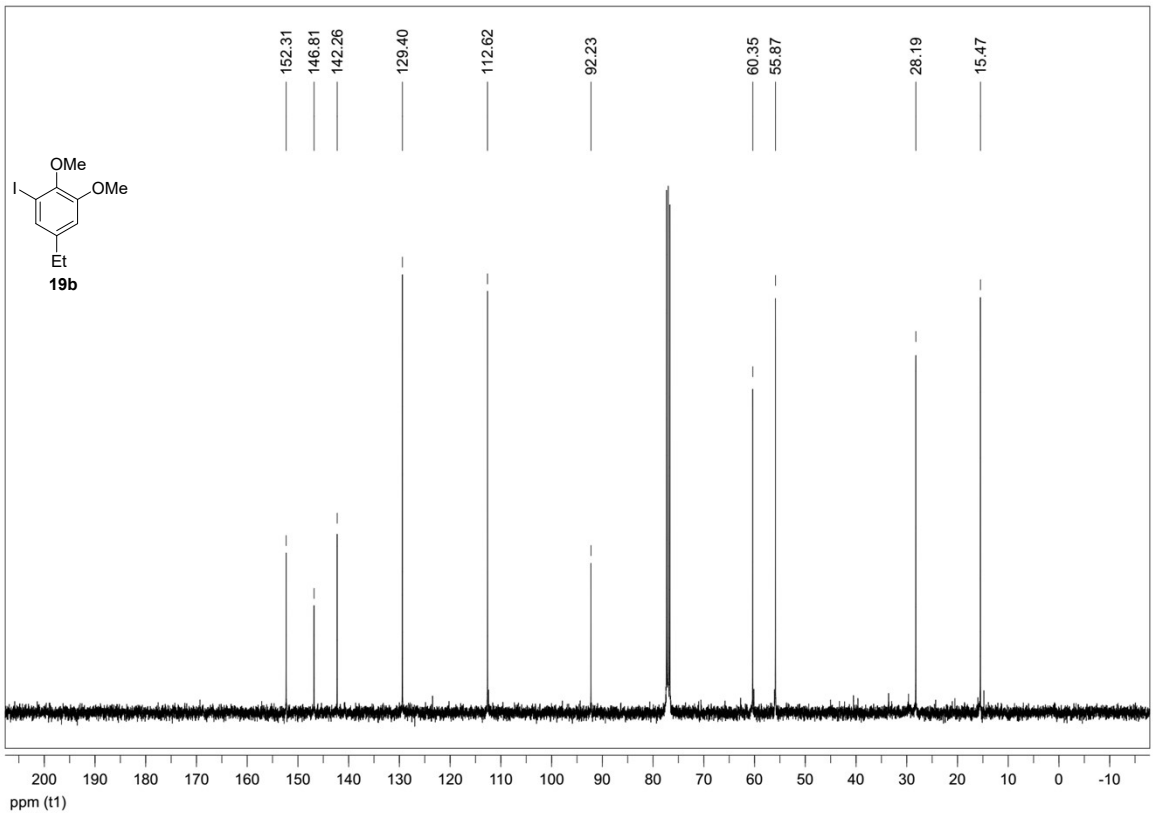


Compound **19b**

^{1}H NMR (400 MHz, $CDCl_3$)

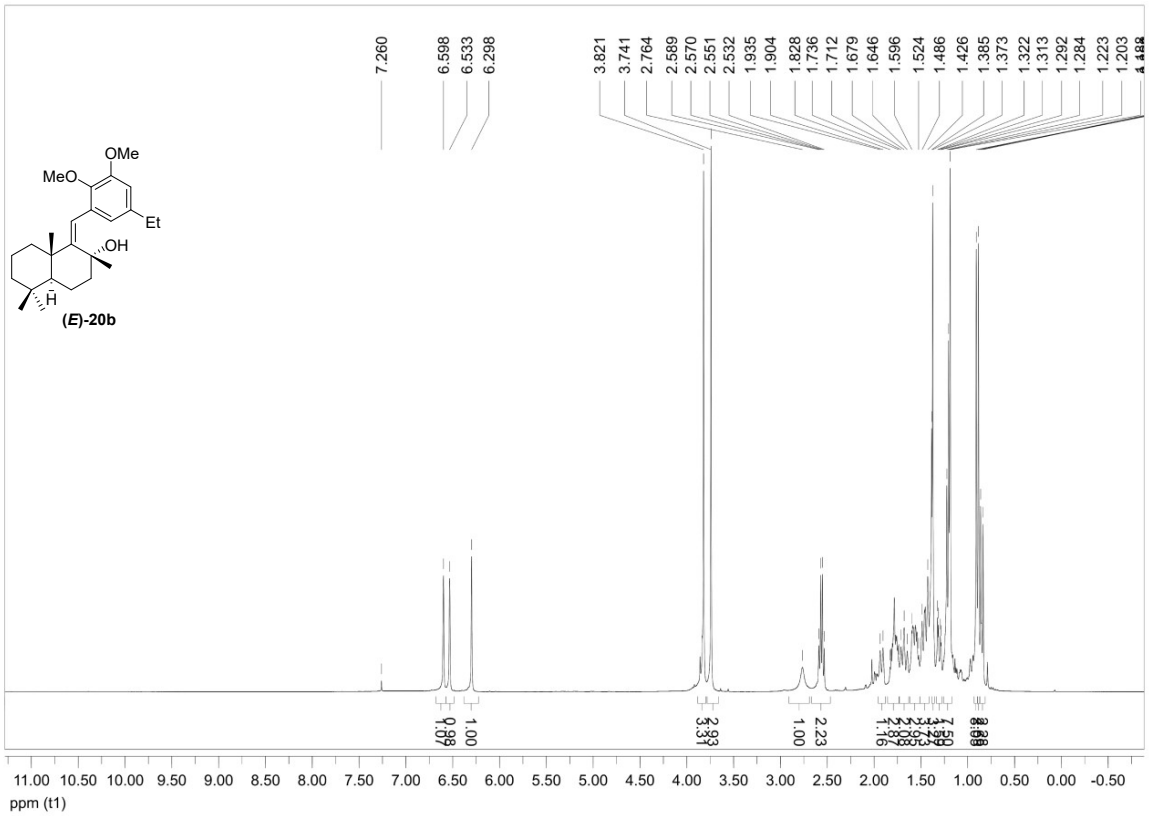


^{13}C NMR (100 MHz, $CDCl_3$)

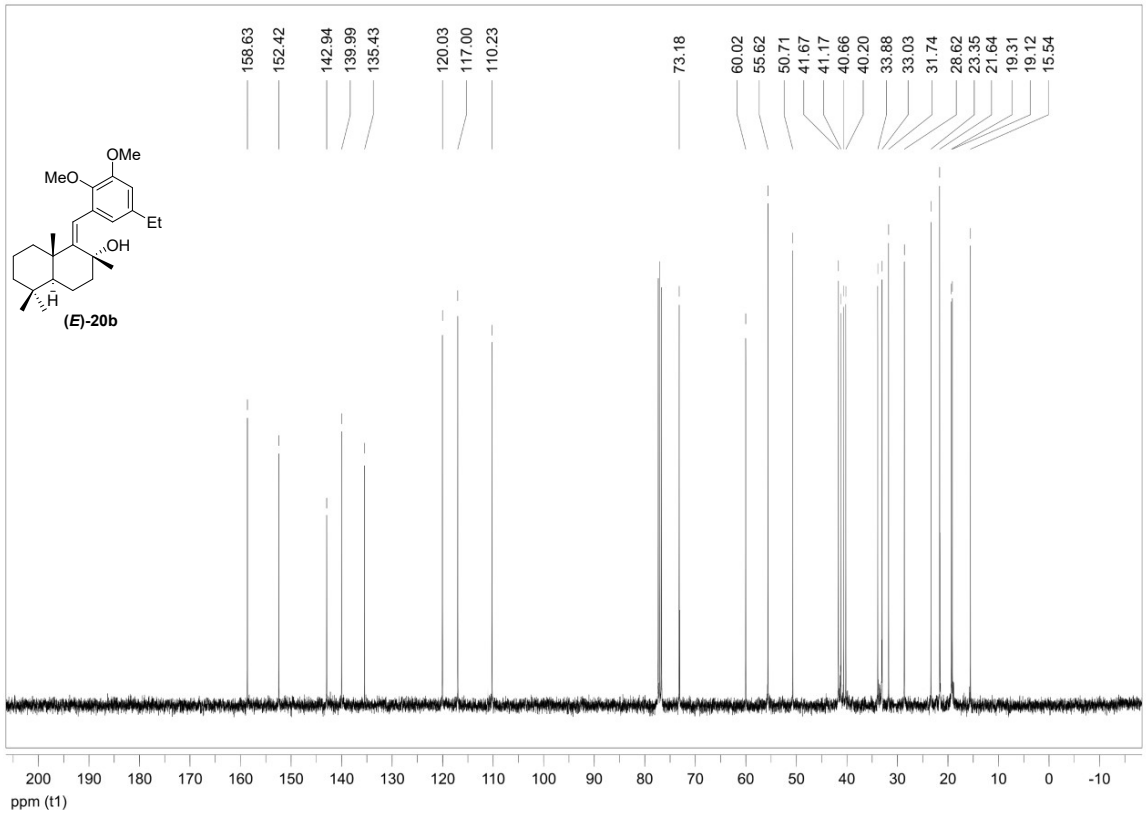


Compound **(*E*)-20b**

^{1}H NMR (400 MHz, $CDCl_3$)

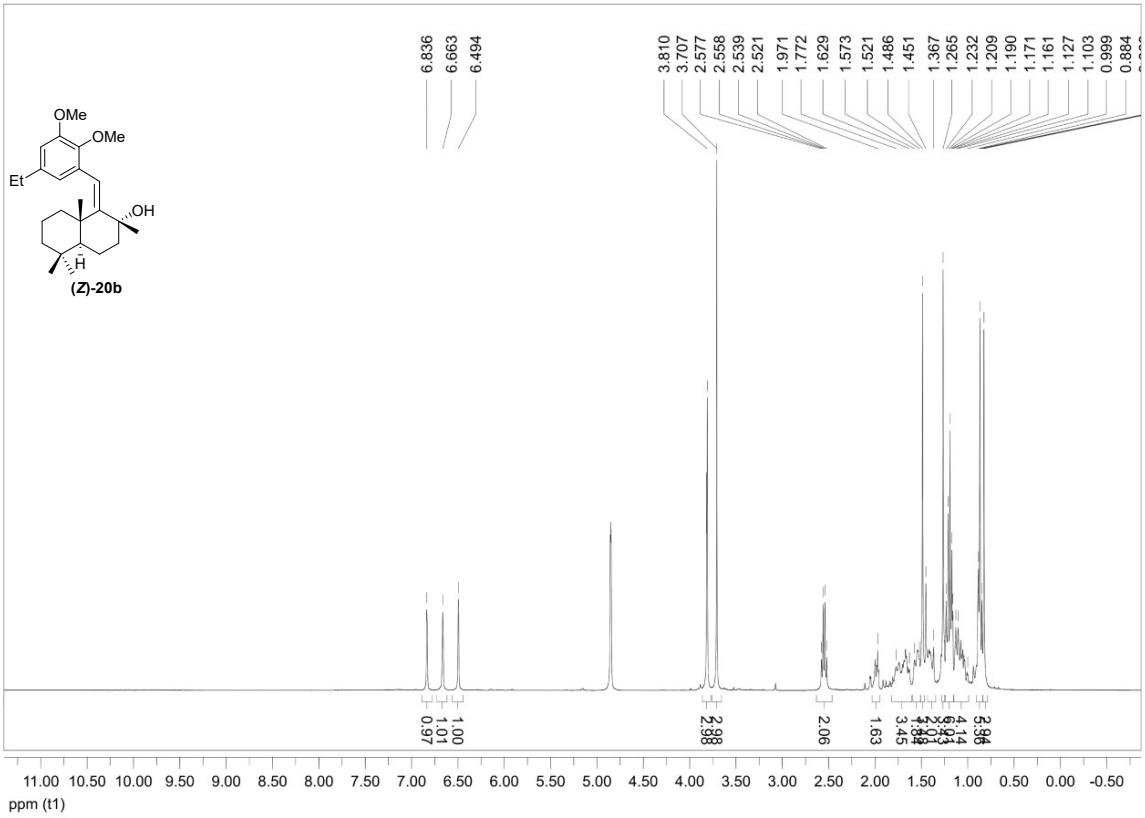


^{13}C NMR (100 MHz, $CDCl_3$)

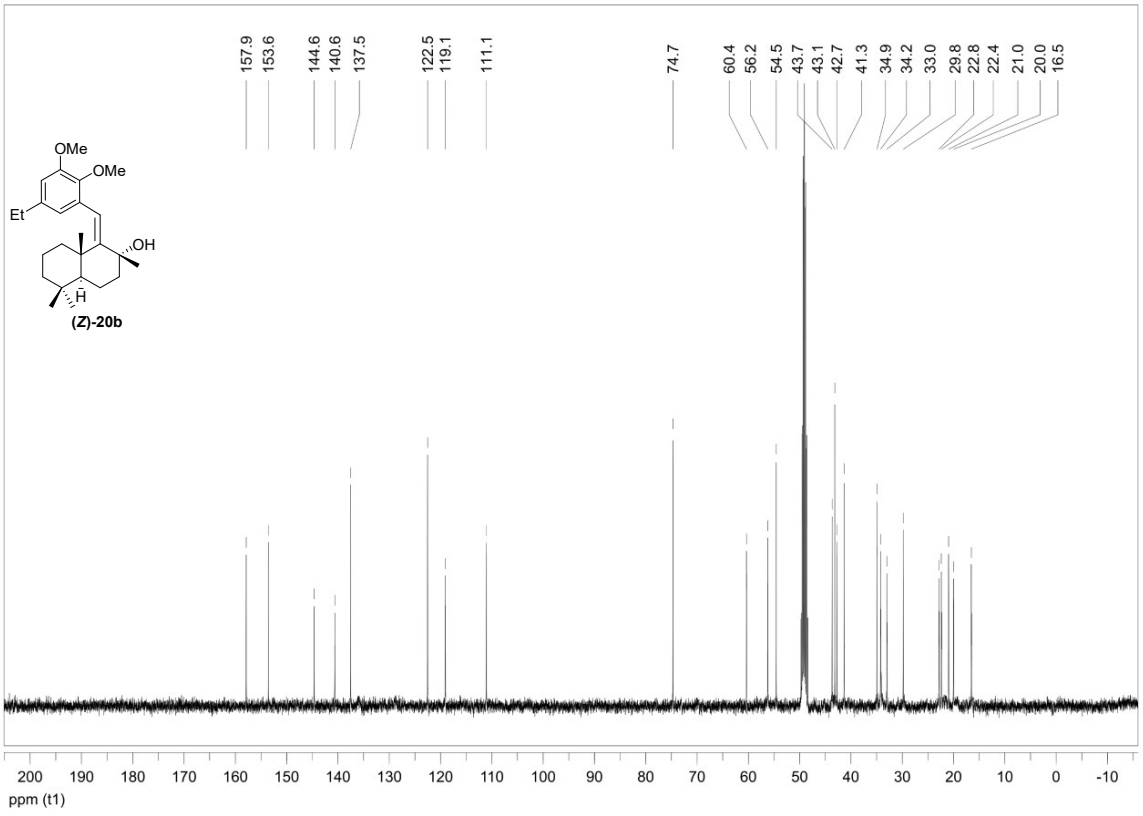


Compound **(*Z*)-20b**

^{1}H NMR (400 MHz, MeOD)

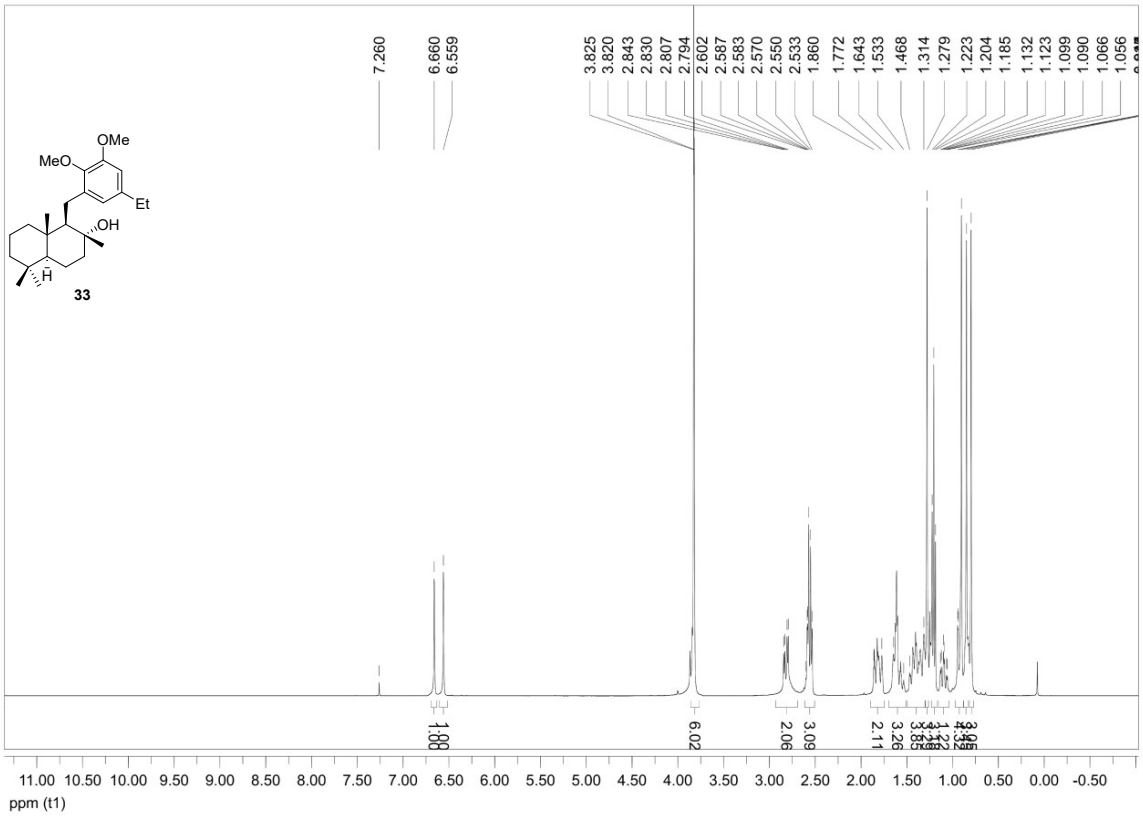


^{13}C NMR (100 MHz, $CDCl_3$)

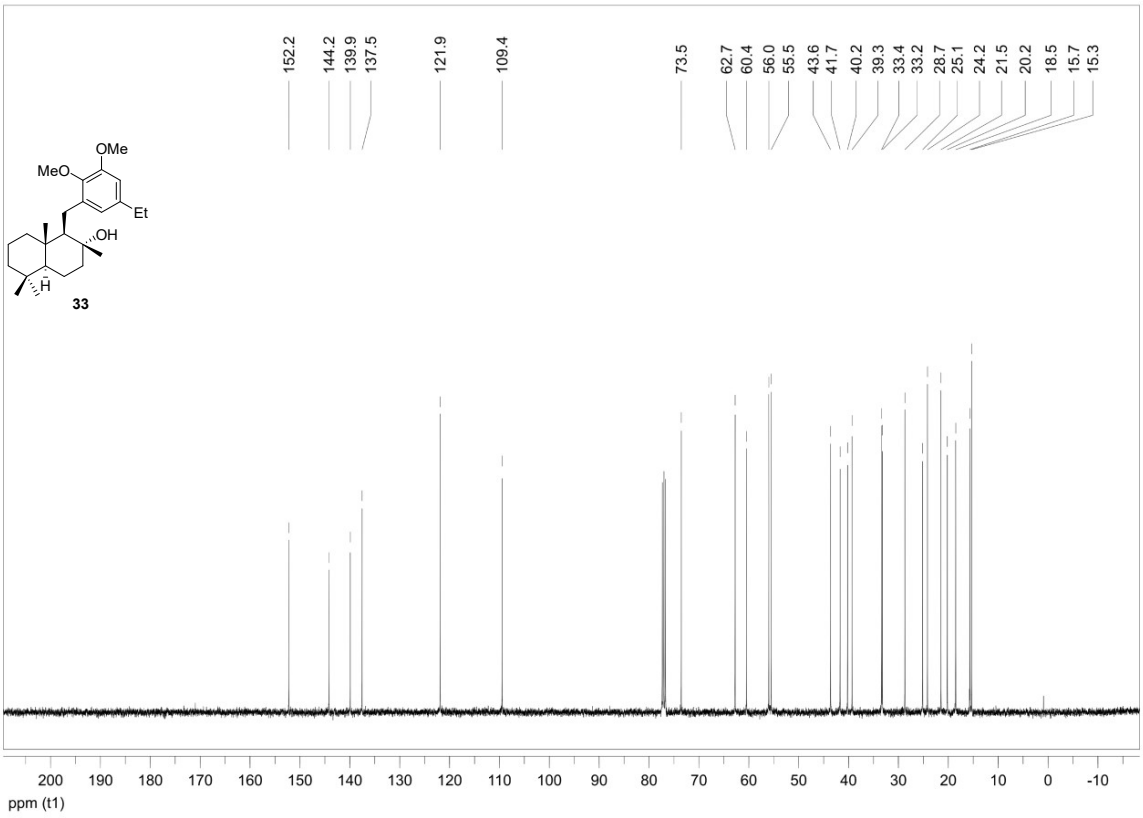


Compound **33**

^{1}H NMR (400 MHz, $CDCl_3$)

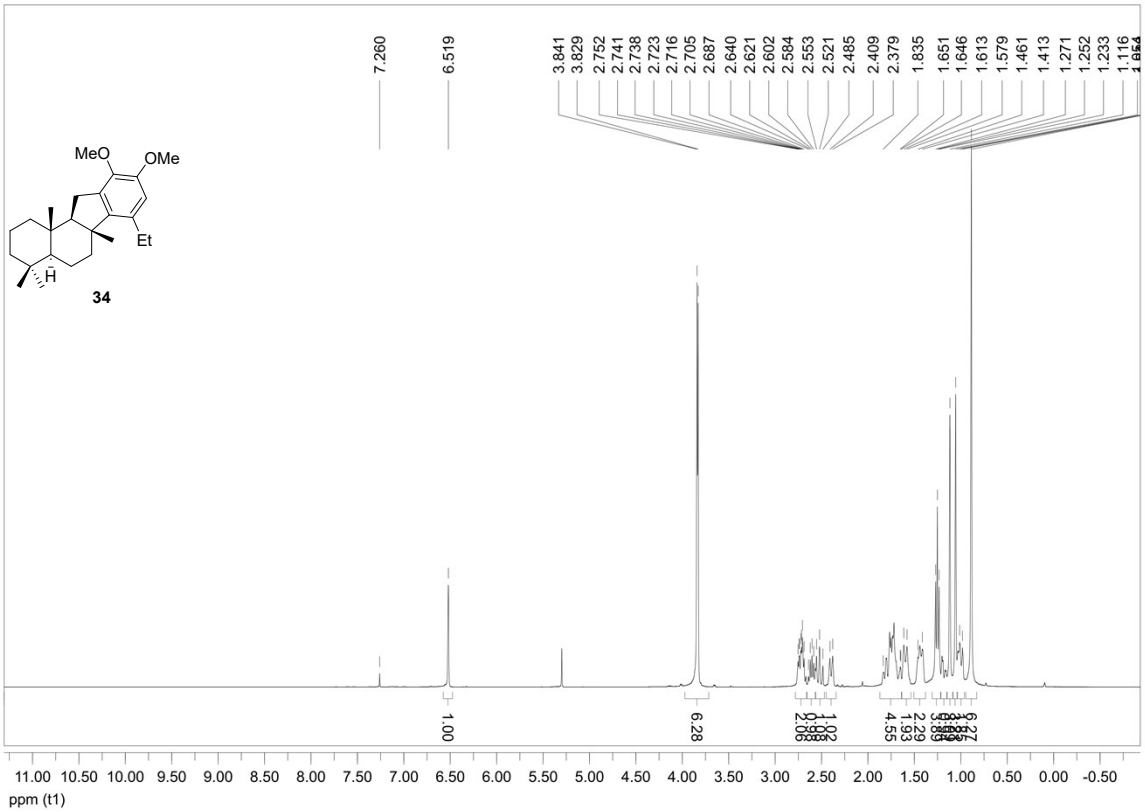


^{13}C NMR (100 MHz, $CDCl_3$)

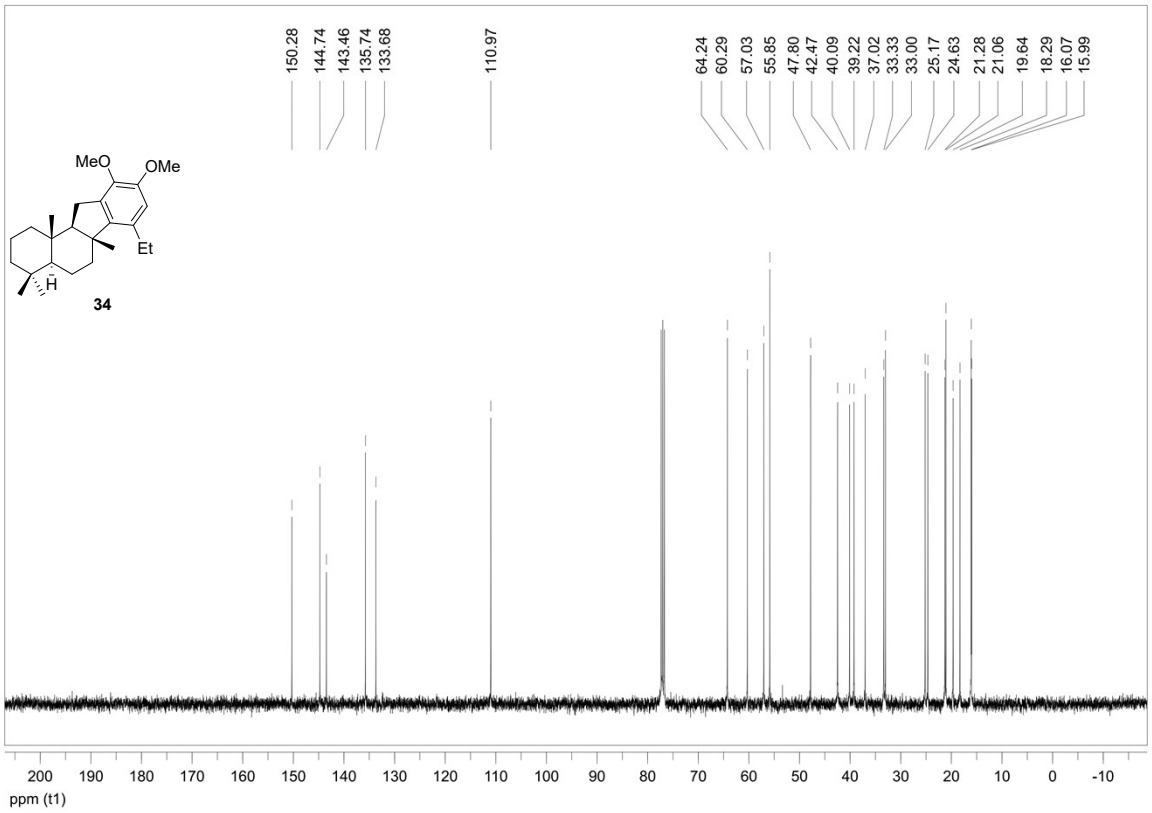


Compound **34**

^{1}H NMR (400 MHz, $CDCl_3$)

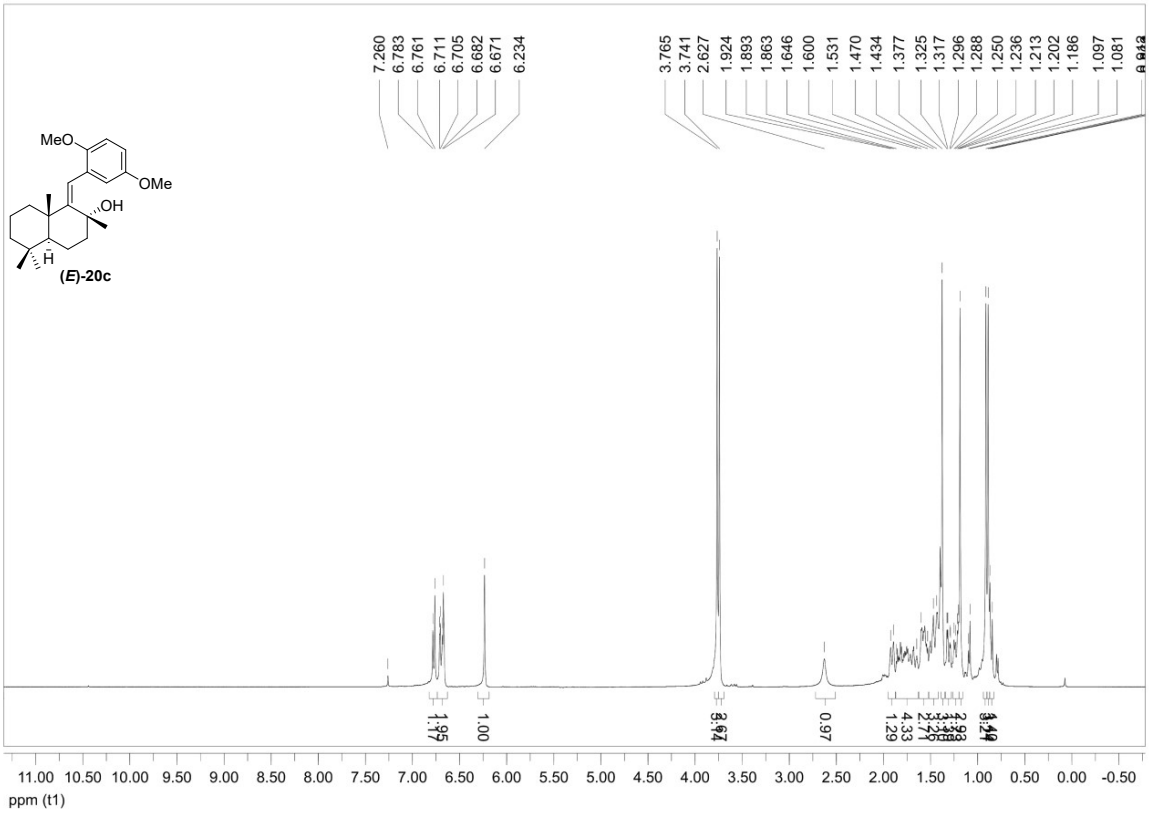


^{13}C NMR (100 MHz, $CDCl_3$)

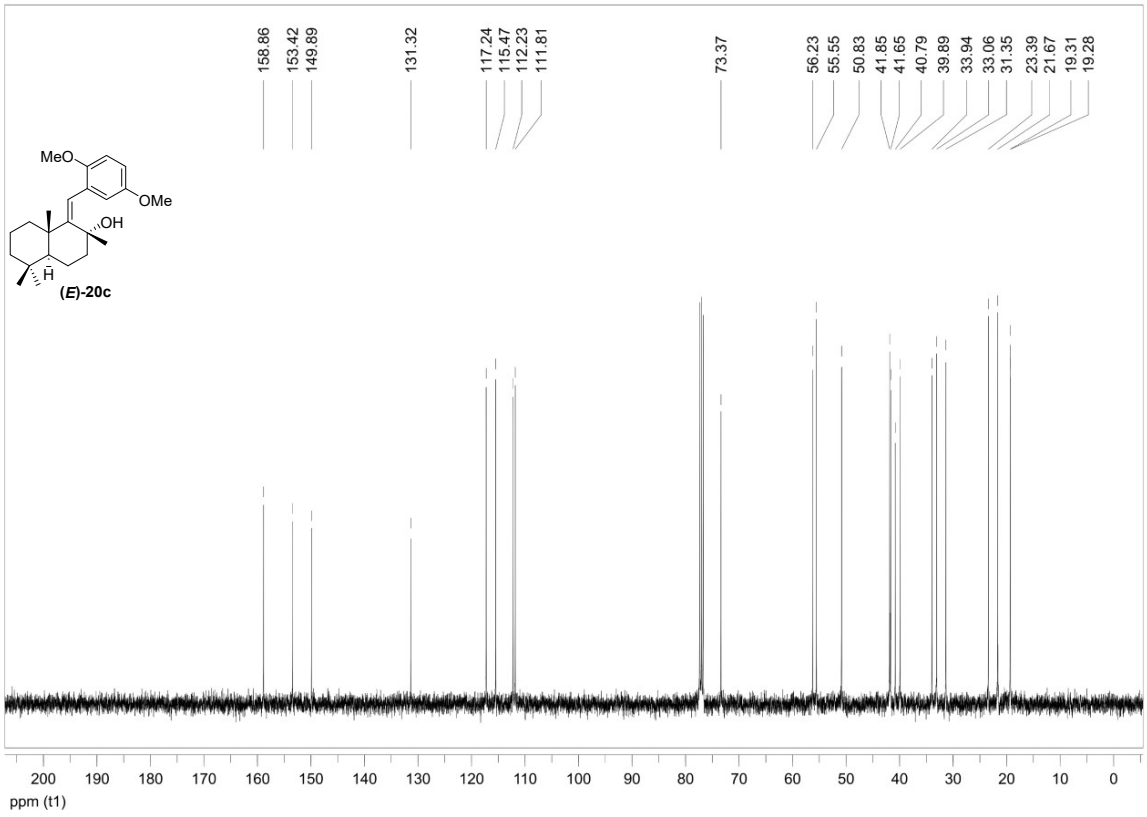


Compound **(*E*)-20c**

^{1}H NMR (400 MHz, $CDCl_3$)

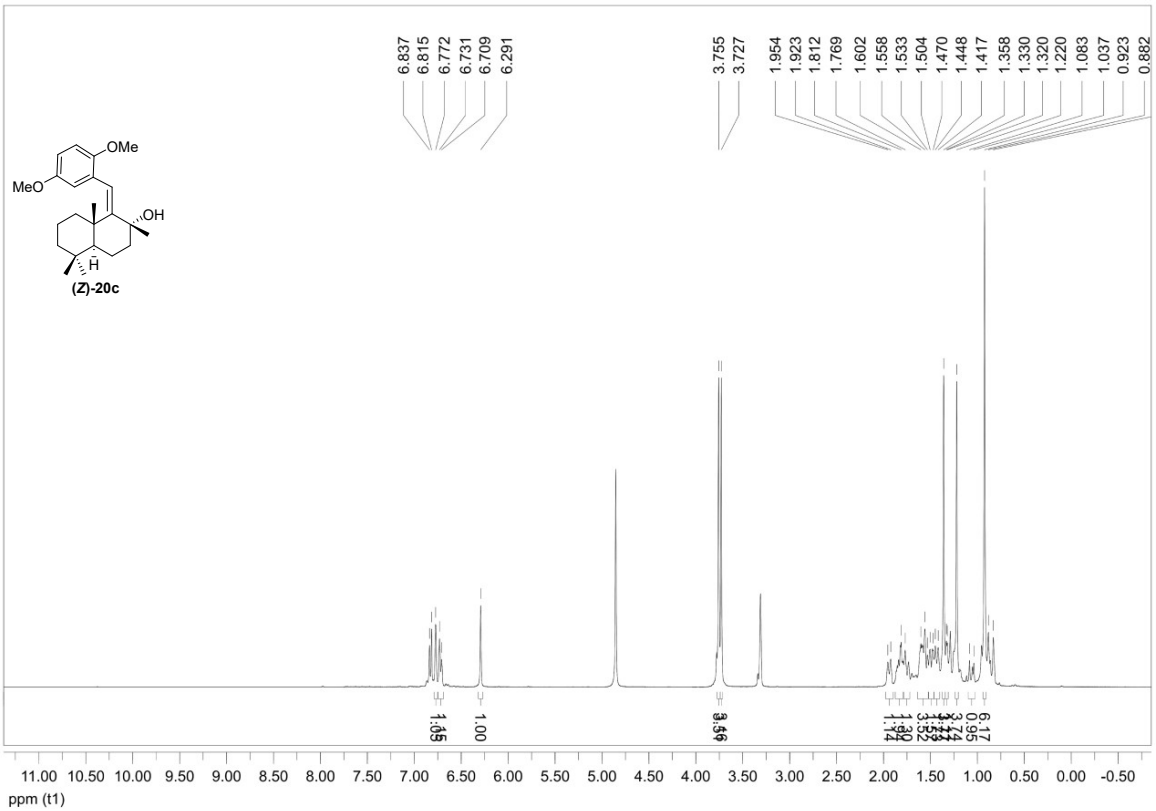


^{13}C NMR (100 MHz, $CDCl_3$)

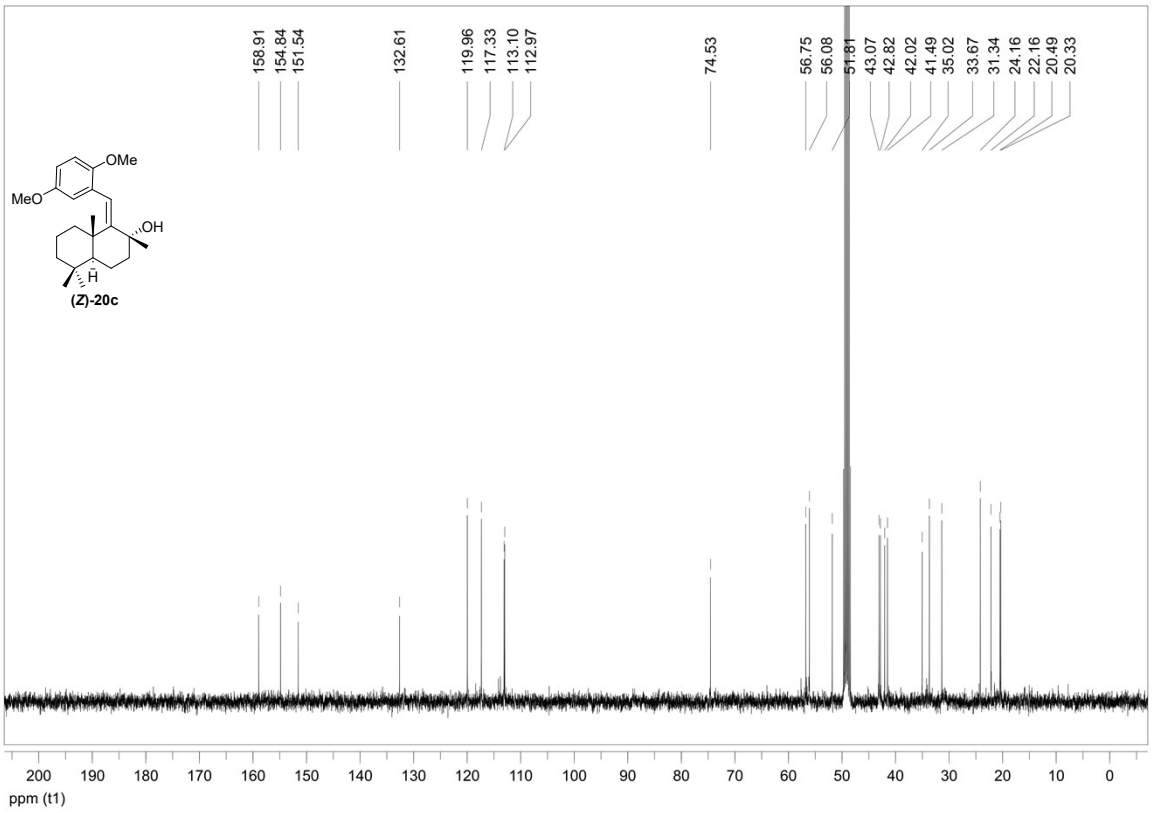


Compound **(*Z*)-20c**

^{1}H NMR (400 MHz, MeOD)

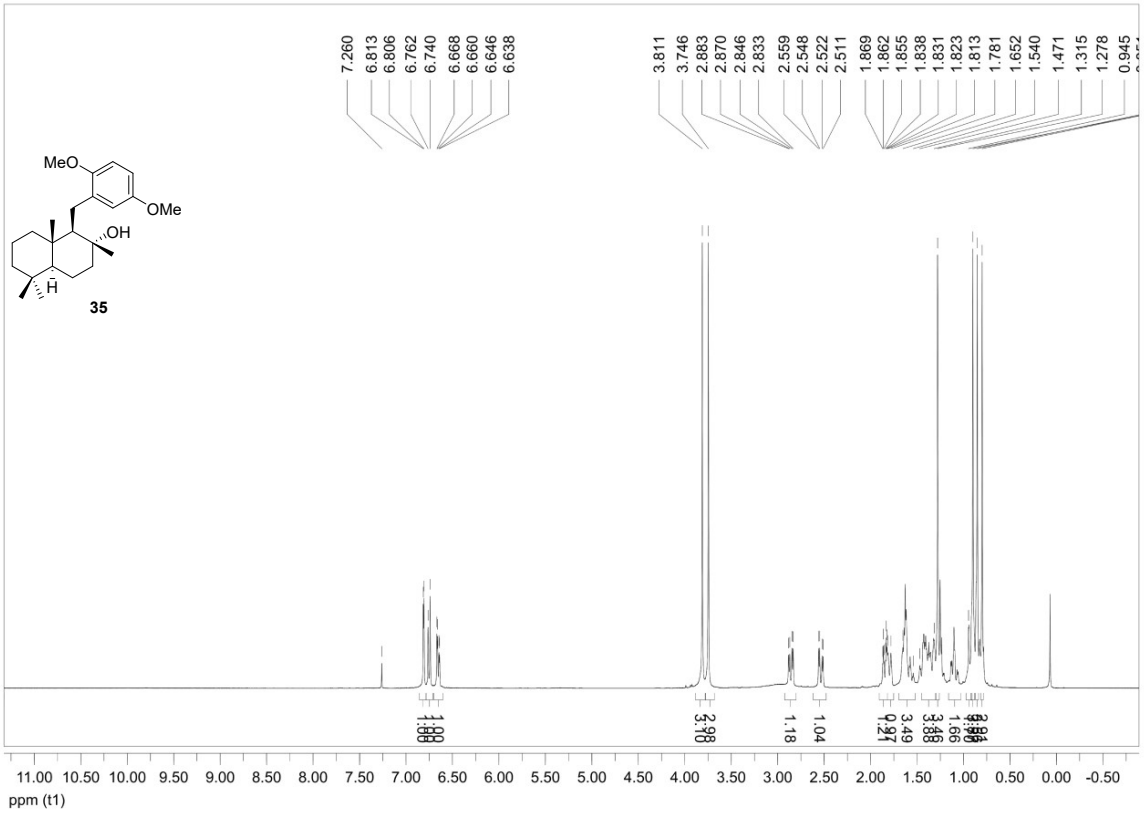


^{13}C NMR (100 MHz, MeOD)

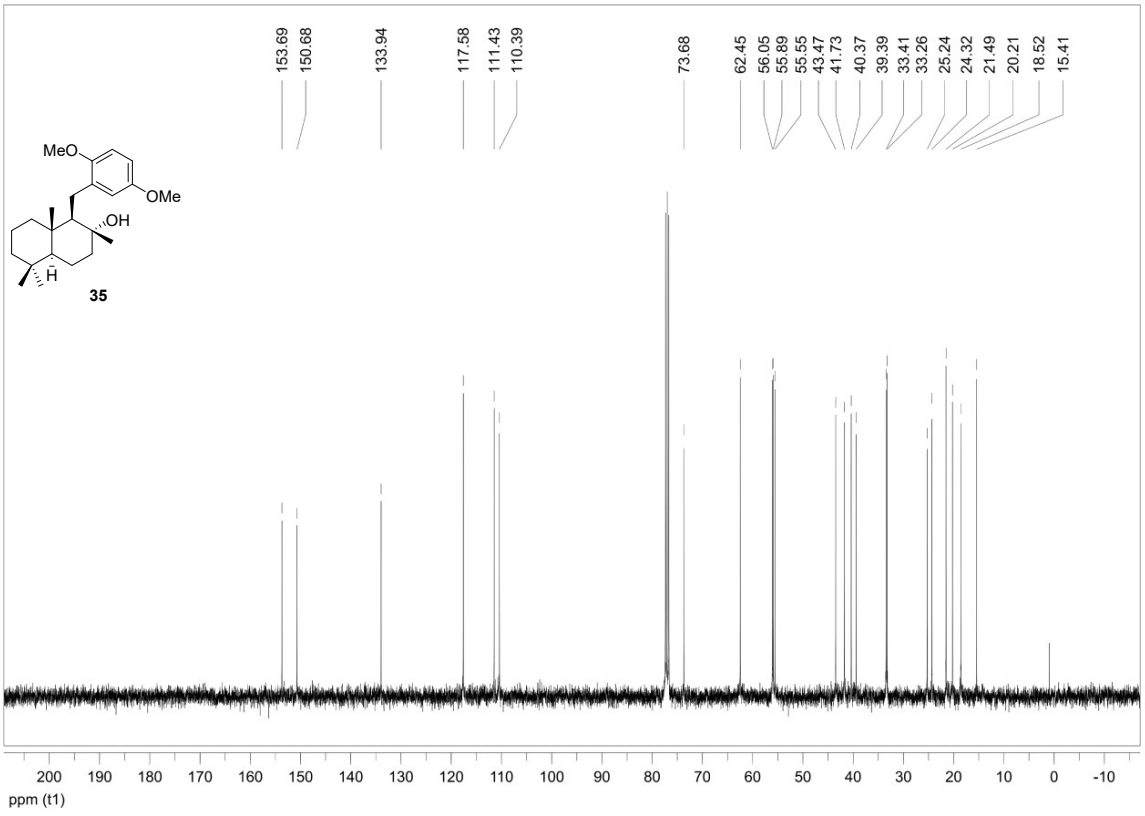


Compound **35**

^{1}H NMR (400 MHz, $CDCl_3$)

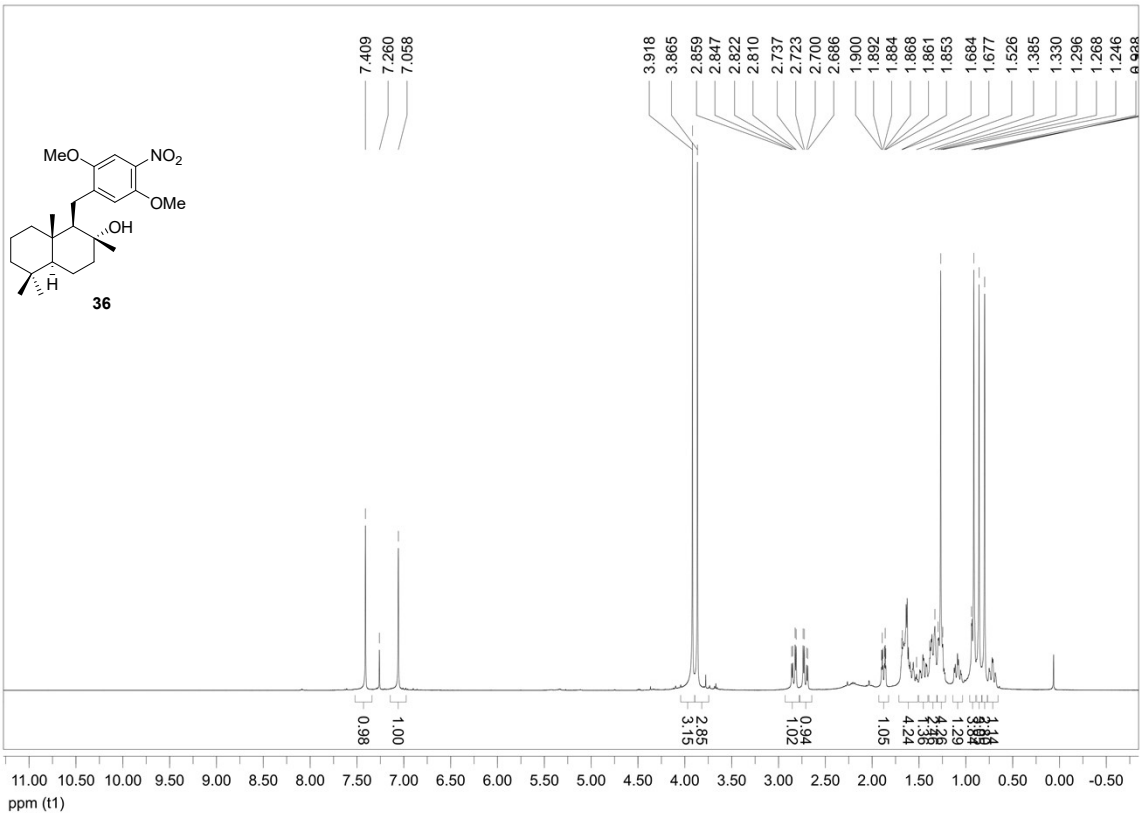


^{13}C NMR (100 MHz, $CDCl_3$)

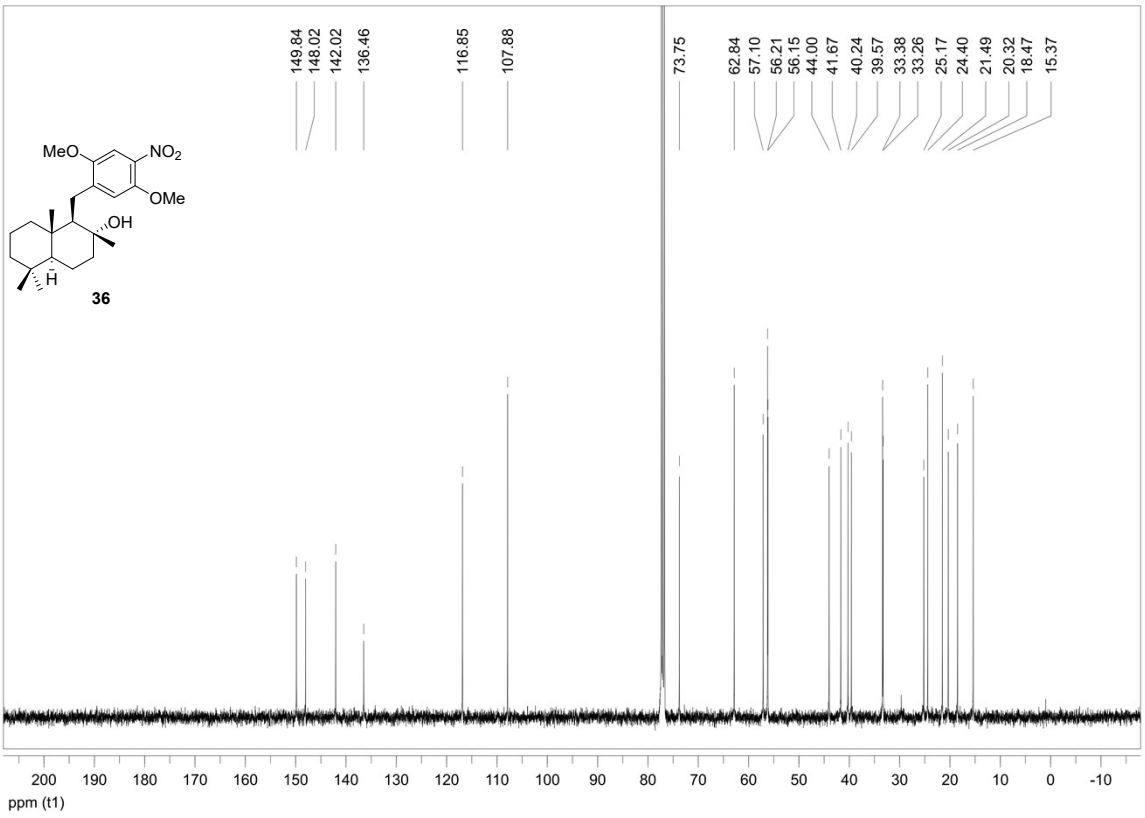


Compound **36**

^{1}H NMR (400 MHz, $CDCl_3$)

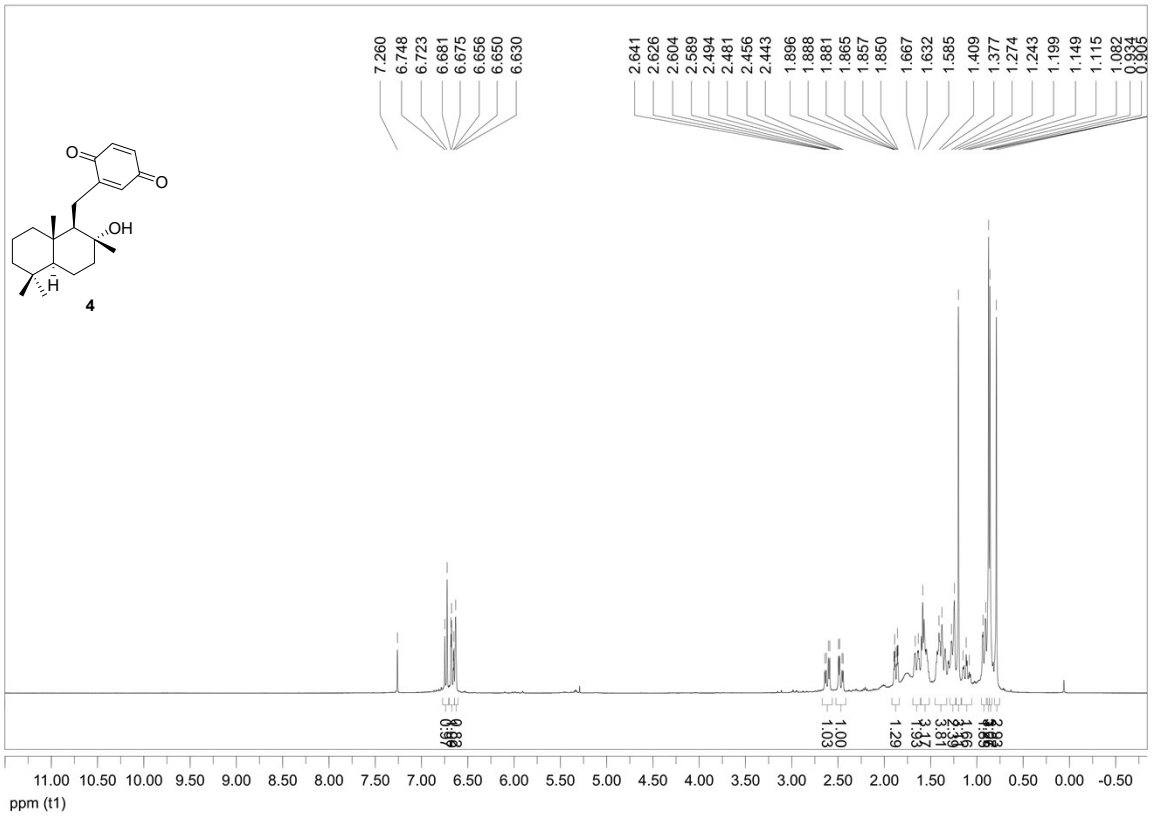


^{13}C NMR (100 MHz, $CDCl_3$)

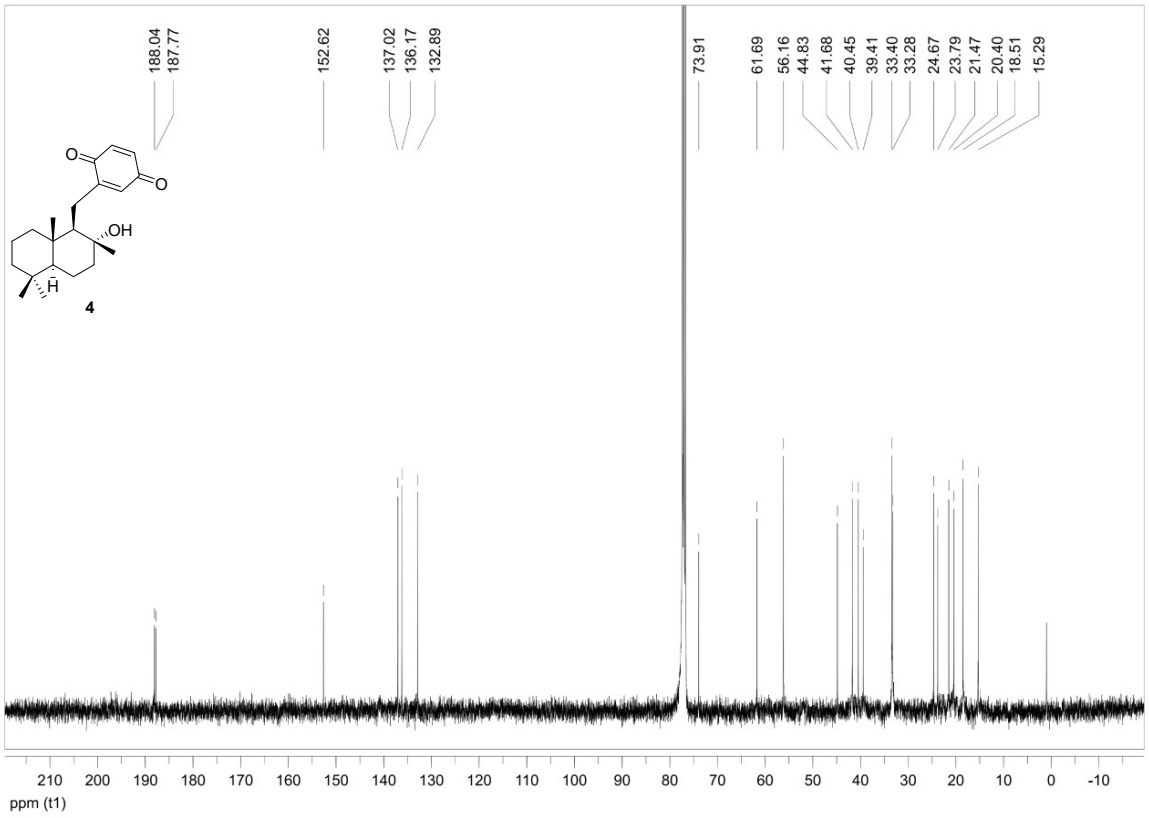


Compound **(+)-yahazunone (4)**

^{1}H NMR (400 MHz, $CDCl_3$)

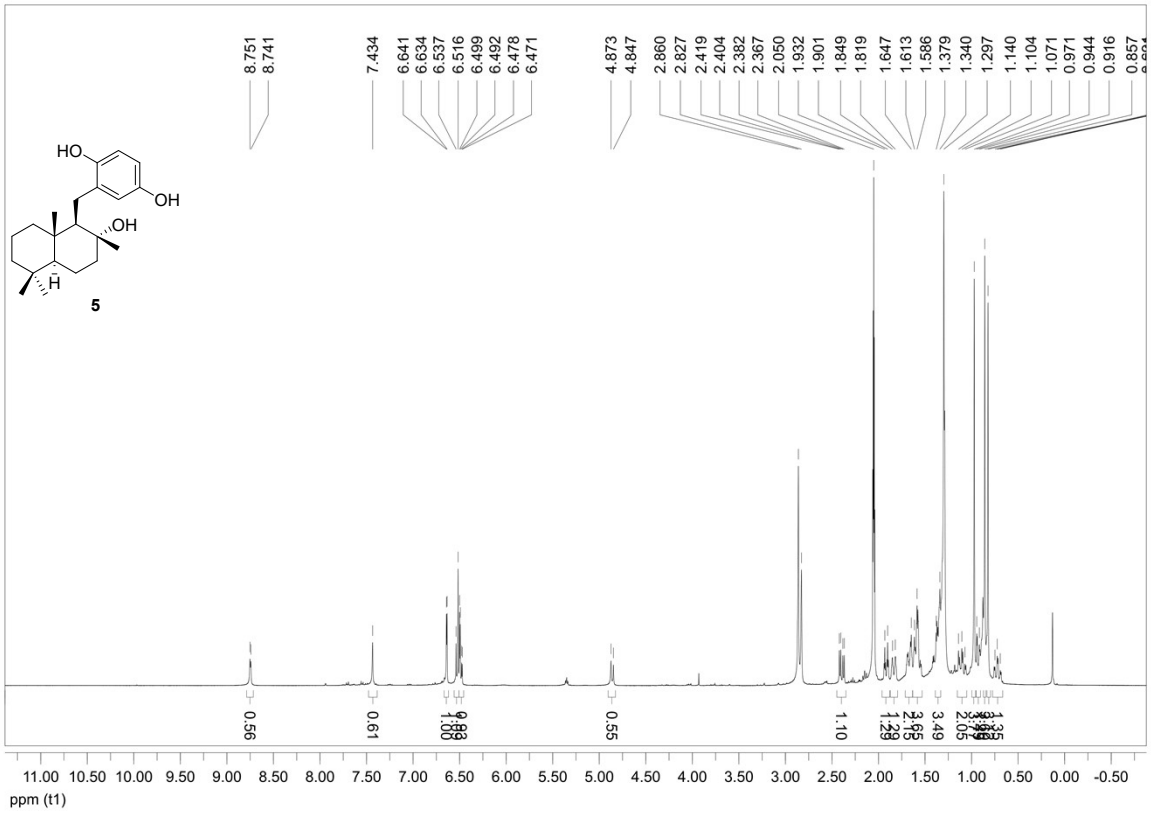


^{13}C NMR (100 MHz, $CDCl_3$)



Compound **(+)-yahazunol (5)**

^{1}H NMR (400 MHz, Acetone-d_6)



^{13}C NMR (100 MHz, Acetone-d_6)